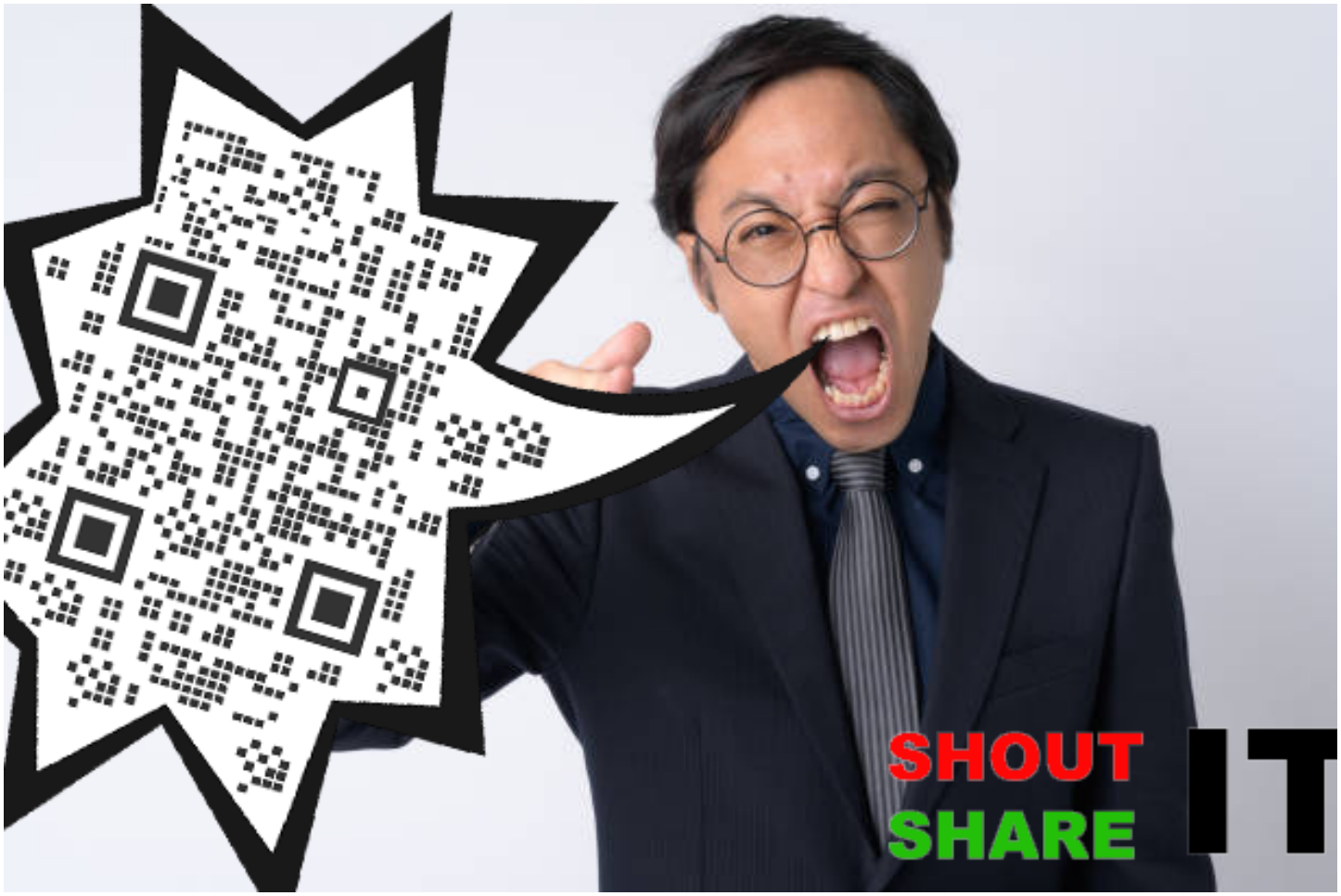
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BULLETIN No. 13

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF BIOLOGICAL SURVEY

FOOD

OF THE

BOBOLINK, BLACKBIRDS, AND GRACKLES

BY

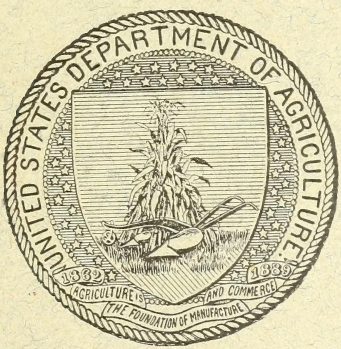
F. E. L. BEAL, B. S.

ASSISTANT BIOLOGIST

PREPARED UNDER THE DIRECTION OF

DR. C. HART MERRIAM

CHIEF OF BIOLOGICAL SURVEY



WASHINGTON

GOVERNMENT PRINTING OFFICE

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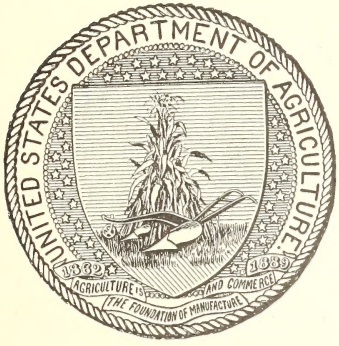

WASHINGTON

GOVERNMENT PRINTING OFFICE

1900

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., May 22, 1900.

Sir: I have the honor to transmit herewith for publication as Bulletin No. 13 a report on 'The Food of the Bobolink, Blackbirds, and Grackles,' by Prof. F. E. L. Beal, assistant biologist. This report is based on a careful examination of the contents of more than 4,800 stomachs, representing nine species and several subspecies of American blackbirds. The family of orioles and blackbirds, to which the bobolink, cowbird, blackbirds, and grackles belong, is one of much economic importance. The ravages of the bobolink in the rice fields of the South, and of some of the blackbirds in the grainfields of the Upper Mississippi Valley at planting and harvesting time, are matters of common knowledge, but the other food of these and other species is not so well known. The present bulletin is devoted mainly to the food of the various blackbirds during the summer months; several of the species consume insects in such quantities at this time as to compensate in great measure for the grain they destroy.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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FOOD OF THE BOBOLINK, BLACKBIRDS, AND GRACKLES.

By F. E. L. Beal, B. S.,

Assistant Biologist, U. S. Department of Agriculture.

INTRODUCTION.

The birds commonly known as bobolinks, meadowlarks, orioles, blackbirds, grackles, and cowbirds are all comprised in a group known as the family Icteridæ, which is represented in the United States by 29 species and subspecies. These differ remarkably in plumage, nesting habits, and methods of obtaining food. The plain black in which many of them are clothed is relieved in the redwing by a touch of brilliant color, and in the bobolink (in spring dress) by white and buff; in the orioles it is usually reduced to a few patches to offset the bright tints; and in the meadowlarks is restricted to a black crescent on the breast. The orioles build their nests in trees, sometimes at a considerable height, and obtain their food among the leaves and branches. The bobolinks and meadowlarks build upon the ground and depend for food upon such insects and seeds as they find on the surface. The other species take an intermediate position, some, such as the crow blackbird, building in trees, and others on low bushes and rushes, but all obtaining the greater part of their food on the ground.

In this bulletin are discussed the food habits of the bobolink, the cowbird, the yellow-headed blackbird, the red-winged blackbird, the California red-winged blackbird, the rusty blackbird, Brewer's blackbird, the crow blackbird, and the boat-tailed grackle. These comprise all the important members of the group with the exception of the meadowlarks and orioles.[1] One or more of these species may be found at some time of the year in every State and Territory. As they are much given to nesting and feeding about farms and stock yards or to visiting outlying grainfields and pastures, the character of their food becomes a question of considerable importance to the cultivator.

[1]A report on the food of the meadowlark and Baltimore oriole was published in the Yearbook of the Department of Agriculture for 1895, pp. 419–430; a preliminary report on the food habits of the crow blackbird appeared in the Yearbook for 1894, pp. 233–248; and the grain-eating habits of most of the blackbirds were discussed under the title 'Birds injurious to grain,' in the Yearbook for 1897, pp. 345–354.

Writers on ornithology give notes on the food of various species of birds, based for the most part on field observation, and in some cases on examination of stomachs, but usually such investigations are neither extensive nor systematic. In the early days, when birds were abundant and grainfields few, blackbirds, or 'maize thieves,' as they were called, were the first species to render themselves objects of notice by their attacks upon the crops of the early settlers, and bounties were offered for their destruction; in fact, they had already acquired a bad reputation with the aborigines by their depredations upon the patches of maize. Their very pronounced taste for grain, and their habit of associating in large flocks, soon attracted the attention of pioneer farmers everywhere; and it did not take these shrewd observers long to decide that the birds were a nuisance and to plan for their extermination. All devices of this kind, however, have (fortunately, perhaps) proved futile. The birds still flourish, though in somewhat reduced numbers, and are still a source of considerable damage in many places.

At the present day direct bounties are not so much in vogue as they were when the country was newer; and State laws protecting birds have become numerous. But the evil repute of the blackbirds has caused them to be omitted from many of these statutes, while in others either blackbirds in general or particular species are specially exempted from protection. Blackbirds in general are specially exempted in Maryland, Michigan, Wisconsin, Minnesota, and Arkansas; the crow blackbird in Vermont, Massachusetts, South Carolina, and Illinois; the ricebird (bobolink) in Georgia; the 'common blackbird' and the crow blackbird in New York; the crow blackbird in Rhode Island; and the crow blackbird and redwing in New Jersey.

In certain States near the Atlantic seaboard some species, notably the bobolink, are regarded as game, and an open season is provided for shooting them. In New Jersey 'reedbirds' (bobolinks) may be lawfully killed from August 25 to January 1; in Pennsylvania from September 1 to November 30; in Delaware from September 1 to February 1; and in Maryland between September 1 and November 1. In the District of Columbia the redwing is included with the bobolink, and shooting is permitted on Tuesdays, Thursdays, and Saturdays, between August 21 and February 1.

The investigation of the food of blackbirds by the examination of the contents of their stomachs, while confirming to a certain extent the popular estimate of their grain-eating propensities, has shown also that during the season when grain is not accessible these birds destroy immense quantities of seeds of harmful weeds, and that during the whole of the warmer portion of the year, even when grain is easily obtained, they devour a great number of noxious insects. The vegetable portion of the food usually considerably exceeds the animal.

The latter consists mostly of insects,[1] with the addition in a few species of some crustaceans and snails and now and then a small vertebrate. The vegetable food comprises chiefly hard seeds, of which any grain may be taken as a sample. Fruit is eaten by a few species, but not to an injurious extent, and various other vegetable substances are occasionally taken, such as bits of fleshy tubers or roots, mast, mushrooms, etc.

If the blackbirds were to be rated in the order of their grain-eating propensities as shown by stomach examinations, putting those that eat least at the head of the list, they would stand about as follows: Bobolink, redwing, cowbird, rusty blackbird, yellowhead, crow blackbird, boat-tailed grackle, Brewer's blackbird, and California redwing. It is a singular fact that the first two are the ones against which the greatest complaint has been made, thus showing that some factors beside the amount of grain actually eaten by the individual must be taken into account in determining the relative harmfulness of the species. In the case of the bobolink, however, it should be explained that the stomachs upon which the record is founded were nearly all taken in the North, and do not exhibit the bird's rice-eating propensities. Still it is probable that if a proportionate number of stomachs from Southern States were included in the examination there would be no great change in the result. The damage from which the complaint arises is due to the fact that all the bobolinks reared in the Eastern States gather in spring and autumn upon a limited area and attack a single crop—rice. But owing to the comparative shortness of the rice-eating period the amount consumed by each bird must constitute but a small percentage of the food of the year.

The redwing probably owes its bad reputation as a grain eater to its superabundance in the great grain-raising regions of the West. Number of individuals, rather than amount of grain consumed by each, is here probably the important factor. The cowbird, well known as a frequenter of roads and barnyards, is not notorious as a grain eater, and it is probable that the greater part of the 16 percent of grain found in its stomach is waste. The rusty blackbird has not been accused of much damage, and in fact is not in this country at harvest time, so that the greater part of the grain it eats is also probably waste. The yellowhead has gained an unenviable reputation in some parts of the West, and in point of harmfulness is reckoned by the farmers with the redwings, with which it associates. This is not surprising, as nearly 40 per cent of its food is grain; if it were as abundant as the redwing, it would probably be a much greater nuisance than that species. The crow blackbird, while eating a consider-

[1] For convenience, spiders and myriapods (thousand-legs) are classed as insects in this investigation.

able quantity of grain, has not been the cause of so much complaint as the foregoing species, perhaps because of its well-known habit of nesting about farmsteads, where it obtains a large portion of its food from the barnyards and grain cribs. The boat-tailed grackle is so local in its distribution that its food habits are familiar to comparatively few. It confines its grain eating almost exclusively to corn, which it appears to eat at every opportunity. Unlike most of the other species, it also damages fruit. The western Brewer's blackbird, with grain constituting more than 60 percent of its food, would naturally be supposed to be a dangerous neighbor for the grain grower, and where it has come in contact with the grainfield it has fulfilled this expectation. The California redwing is confined to a comparatively small part of the country, and its food habits have not yet received much attention. It seems almost certain that it must become a nuisance, but the record of its food is too meager to justify final conclusions.

The animal food of these nine species of blackbirds must be counted for the most part in their favor, as the insects eaten are generally noxious. Only one species (the crow blackbird) shows any special fondness for the valuable predaceous beetles (Carabidæ), and these amount to less than 6 percent of its food. The snout-beetles (Rhynchophora), commonly known as weevils, seem to be specially sought during the early summer. In the five months from April to August, inclusive, 9 percent of the food of the bobolink consists of these harmful beetles, a record which is slightly exceeded by the redwing for the same time. In May they constitute more than one-fourth of the food of Brewer's blackbird. As all the members of this group of beetles are noxious, and as two species that have been identified in great numbers in the birds' stomachs are very harmful to forage crops, the benefit derived from this destruction is obvious. In the consumption of grasshoppers, Brewer's blackbird heads the list, more than 16 percent of its food consisting of these pests; while the redwing (excluding the California bird) stands at the foot, with a little less than 6 percent. In August, Brewer's blackbird takes more than 47 percent of its food in grasshoppers, and the rusty blackbird and cowbird only a little less. Being mainly terrestrial, the blackbirds do not naturally come in contact with caterpillars so frequently as they would if they sought their food upon trees or shrubs; but nevertheless these insects constitute 13 percent of the food of the bobolink, nearly 6 percent of that of the redwing, and but little less of that of several others. The other insects eaten are, with an occasional exception, harmful, and though distributed among several different orders, form a noticeable percentage of the food. The crustaceans and snails may be considered neutral.

In regard to the economic status of the blackbirds, it may be said that the damage done by the redwings and some other species has apparently arisen from the excessive number of individuals rather than from the habits of the species. Thoughtful students of nature have observed that every race or species has a certain high-water mark of abundance, beyond which it can not rise without danger of encroaching upon and injuring other species. This is true of every species, whether at its normal abundance it be beneficial to man or otherwise. The exemplification of this principle is most noticeable in the case of insects, many species of which frequently exceed their ordinary bounds and spread destruction among crops. But the rule is equally applicable to birds; however useful they may be in a general way, it is possible under certain conditions that particular species may become too numerous.

There is no reasonable doubt that in the Mississippi Valley the redwings and yellowheads, and farther west Brewer's blackbird, are much too abundant for the interests of the grain grower. The facilities for nesting afforded by the prairie sloughs and marshes, where for ages these species have been undisturbed, have given rise to such immense hordes that they can in a few hours destroy hundreds of acres of grain, or at least take so much that the remainder is not worth harvesting. Originally the birds obtained their food from wild plants, but with the advent of civilized man and the planting of grain-fields a new source of food was provided. The wild rice (*Zizania aquatica*), which was one of their favorite foods, does not ripen till September, but wheat and oats are ripe from June to August, and are much more abundant and more easily obtained than any of the wild seeds. What wonder that the birds at once availed themselves of this new supply of food spread before them with such a lavish hand! In the early days of settlement the fight near large marshes to save the grain from redwinged blackbirds was as fierce as is now the struggle in the South to save the rice crop from the bobolinks. As the country has become more thickly settled a greater area of grain is sown and the damage is relatively less and more widely distributed. With the further advance of civilization, and the broadening of the area of cultivation, many of the marshes will be drained and the present nesting places will become arable fields. This will necessarily reduce the numbers of the birds, and it is almost certain that in time they will reach the limit at which they are no longer harmful, as is already the case in the Eastern States.

Perhaps the most peculiar case presented by any of our birds is that of the bobolink. Loved and cherished in the North, and there made the subject of poetry and romance, in the South it is execrated and destroyed and conceded but one redeeming quality—that its body is

good to eat. In the North it does much good and practically no harm; in the South it becomes a veritable pest. To a person born and reared in New England and taught to regard this bird somewhat as the Hollanders regard the stork, it is an unwelcome duty to pronounce upon it a verdict of condemnation, but the facts force the belief that until some practical method shall be devised to prevent its ravages upon the rice crop there can be no other conclusion than that the good done by the bobolink does not in any appreciable measure counterbalance the harm.

THE BOBOLINK.

(*Dolichonyx oryzivorus.*)

Within the memory of many persons who have passed the half-century mark most of the literature of the bird world available to Americans was that imported from Europe, and stories of the skylark

FIG. 1.—Bobolink.

and of the little robin-redbreast were the amusement of their simple childhood. They often wondered why they never saw these birds. But when American writers fully awoke to the beauty and attractiveness of their native birds, tales, both in verse and prose, of birds to be seen every day in our own fields and forests began to find their way into the household. Among these familiar little friends one of the first to be enshrined in song and story was the bobolink.

The peculiar difference in the plumage of the two sexes and the idiosyncrasies of the song of the male have long rendered the bobolink a marked bird in its summer home in the Northern States. Few species show such striking contrasts in the color of the sexes, and few have songs more unique and whimsical. Even the early settlers recognized the grotesqueness of some of its notes in their imitative name of 'conquiddle.' In the South it is universally known as the 'ricebird,' from its habit of preying upon rice, while in the Middle States during its southward migration it is called 'reedbird.'

The breeding range of the bobolink is confined to the Transition and Carolinian zones. It occupies the northern part of the United States and the southern part of the British Provinces, extending from the Atlantic to the Rocky Mountains, and locally beyond to eastern Idaho and eastern Nevada (see frontispiece). In winter the bird retires beyond our southern border, ranging southward as far as Brazil. In the last half of April it enters the United States just as the rice is sprouting in Southern rice fields, and at once begins to pull up and feed upon the sprouted kernels. Its stay is short, for this is the season of reproduction, and it hastens northward to enter upon that function.

The nesting usually takes place in a meadow or mowing field, not far from a running brook or spring, and the young are generally upon the wing in the latter part of July. Up to this time they have been fed upon insects, but now the whole family, clad in plain clothes (for the male has lost his bright spring garb), betake themselves to swamps for wild rice, to weed patches for seed, or sometimes to grainfields for oats; but all the time they move slowly toward the South. The small flocks unite; all those that breed in the northeastern part of the country concentrate along the marshes and inlets of the seashore, and the whole body, constantly growing by accessions from other parts of the range, moves steadily southward toward the rice fields—an army vaster than that of Xerxes. The birds begin to arrive upon the rice fields about August 20, and from that time until the last of them wing their way to their winter home, nearly two months later, there is no rest for the unfortunate rice grower. They swarm upon the fields by millions, and when frightened off at one place at once settle upon another a short distance away.

In some of the previous publications on the bobolink the havoc the bird causes among the rice fields of the South does not appear. Audubon mentions its injury to cornfields in Virginia, Maryland, and Pennsylvania, and states that its food consists of grubs, caterpillars, beetles, grasshoppers, crickets, and ground spiders, and the seeds of wild oats (*Zizania aquatica?*), wheat, barley, rice, and other grasses.[1]

[1] Ornith. Biog., Vol. I, pp. 284–286, 1831.

C. J. Maynard speaks of its feeding in Pennsylvania on a somewhat peculiar grass which springs up after the wheat is harvested and affords abundant food for them during the latter part of October.[1]

Dr. Warren also confines himself to its feeding habits in Pennsylvania. He says:

> The food of these birds during their spring sojourn in Pennsylvania is composed chiefly of different kinds of terrestrial insects, also the seeds of various weeds, grasses, etc. I have examined the stomach contents of twenty-seven Bobolinks * * * and found that eighteen had fed exclusively on beetles, larvæ, ants and a few earthworms; five, in addition to insects and larvæ, showed small seeds, and particles of green vegetable materials, apparently leaves of plants; the four remaining birds revealed only small black and yellow colored seeds. After the breeding season the Reedbirds * * * about the middle of August, again make their appearance in our meadows and grainfields. At this time, although various forms of insects are abundant, they subsist almost entirely on a vegetable diet. They visit the cornfields and * * * prey to a more or less extent on the corn; * * * they tear open the tops of the husk and eat the milky grain. Fields of Hungarian grass are resorted to and the seed eagerly devoured. The different seeds of weeds and grasses which grow so luxuriantly in the marshy swamps and meadows are likewise fed upon with avidity.[2]

In these statements the bird's destructiveness in the South is not considered; but it has been well understood for a long time. Mark Catesby, whose work on the natural history of Carolina contains the first published general account of the birds of this country, says:

> In the beginning of September, while the Grain of Rice is yet soft and milky, innumerable Flights of these Birds arrive from some remote Parts, to the great detriment of the inhabitants. *Anno* 1724, an Inhabitant near Ashley river had forty acres of Rice so devoured by them, that he was in doubt, whether what they had left, was worth the expense of gathering in.
>
> They are esteemed in Carolina the greatest delicacy of all other Birds. When they first arrive, they are lean, but in a few days become so excessive fat, that they fly sluggishly and with difficulty; and when shot, frequently break with the fall. They continue about three weeks, and retire by that time Rice begins to harden.[3]

Wilson says these birds are looked upon by the careful planter as a devouring scourge, and worse than a plague of locusts. In disputing the assertion that they were unknown in this part of the continent previous to the introduction of rice plantations he states that the country produces an abundance of food of which they are no less fond, including insects of various kinds, grubs, May-flies, and caterpillars, young ears of indian corn, and seeds of wild rice (*Zizania aquatica*). He believes, however, that the introduction of rice, and more particularly the progress of agriculture, in this part of America has greatly increased their numbers by multiplying their sources of subsistence fiftyfold within the same extent of country.[4]

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[1] Birds of Eastern N. A., p. 131, 1881.

[2] Birds of Pa., revised ed., p. 207, 1890.

[3] Natural History of Carolina, Vol. I, p. 14, 1731.

[4] Am. Ornith., Edinburgh ed., Vol. I, p. 219, 1831.

It is estimated that the bobolinks, with a little help from the redwings, cause an annual loss of $2,000,000 to the rice growers of the South.[1] Much of this loss is indirect, arising from the necessity of maintaining a corps of men and boys as 'bird-minders,' who patrol the fields from morning till night, firing guns or cracking whips to frighten the birds from the ripening crop. Even then it is impossible to save all the rice, and it often happens that some acres on the borders of the uncultivated marsh where the birds resort are so badly eaten that they are not worth harvesting.

As a rule, the shooting is only to frighten the birds, as the use of shot would cause as much harm to the rice as is done by the birds. The amount of powder consumed in this way is enormous. It is not uncommon to use 100 pounds per annum, and one planter who cultivates a large plantation uses 2,500 pounds in the course of a year.

Col. John Screven, of Savannah, Ga., in writing of the ravages of the ricebird (bobolink), says:

> Its invasions are ruinous to fields on which its flocks may settle, especially if the grain is in palatable condition and in fields adjacent to marshes convenient for ambush or retreat. Bird-minders, armed with muskets and shotguns, endeavor by discharges of blank cartridges to keep the birds alarmed and to drive them from the field. Small shot are also fired among them, and incredible numbers are killed; but all such efforts will not prevent great waste of grain, amounting to a loss of large portions of a field—sometimes, indeed, to its entire loss. The voracity of the birds seems so intense that fear is secondary to it, and they fly, when alarmed, from one portion of the field to another, very little out of gunshot, and immediately settle down to their banquet. * * * The preventives in use against the ravages of the ricebirds have been already suggested, but they are palliative only, applied at great expense, and without commensurate results. * * * In short, no effort yet tried consistent with reasonable economy will drive the ricebird from the field or afford any well-founded promise of their reduction to harmless numbers.

A more specific case of damage is that of a field mentioned by Mr. J. A. Hayes, jr., of Savannah, Ga., which consisted of 125 acres of rice that matured when birds were most plentiful, and which, in spite of 18 bird-minders and 11 half kegs of gunpowder, yielded only 18 bushels per acre of inferior rice, although it had been estimated to yield 45 bushels.

Capt. William Miles Hazzard, of Annandale, S. C., says:

> During the nights of August, 21st, 22nd, 23rd, and 24th, millions of these birds make their appearance and settle in the rice fields. From August 21st to September 25th our every effort is to save the crop. Men, boys and women are posted with guns and ammunition to every four or five acres, and shoot daily an average of about one quart of gunpowder to the gun. This firing commences at first dawn of day, and is kept up until sunset. After all this expense and trouble our loss of rice per acre seldom falls under five bushels, and if from any cause there is a check to the crop during its growth which prevents the grain from being hard but in a milky condition, the destruction of the rice is complete—not paying to cut and bring out of

[1] Report of Department of Agriculture for 1886, p. 247.

the field. We have tried every plan to keep these pests off our crop at less expense and manual labor than we now incur, and have been unsuccessful. Our present mode is expensive, imperfect and thoroughly unsatisfactory, yet it is the best we can do.

Mr. R. Joseph Lowndes, of Annandale, S. C., in writing of the bobolink and redwing, says:

I think I am in bounds when I say that one-fourth, if not one-third of the [rice] crop of this river [the Santee] is destroyed by birds from the time the seed is put into the land till the crops are threshed out and put in the barns—I shoot out about 100 kegs of powder every September, with a fair quantity of shot, say 30 to 50 bags, and have killed as high as 150 dozen in a day. In the bird season it takes every man and boy on the plantation to mind these birds. This work has to go on from daylight till dark in any and all weathers and at great expense for six weeks in the fall before the rice is ripe enough for the sickle, and then on till we can get it out of the fields. These birds, if not carefully minded, will utterly destroy a crop of rice in two or three days.

Mr. A. X. Lucas, of McClellanville, S. C., says:

The annual depredations of the birds are in my opinion equal in this section to the value of the rent of the land—to say nothing of the expense of minding the birds.

Many similar reports of the bobolink's damage to rice have been received by the Biological Survey from Southern rice growers. So destructive are the attacks of these birds that it is necessary to plant the rice previous to their coming in the spring, so that it can be under water when they arrive, and then to plant another lot when they have passed on to the north. This method is adopted not only to avoid the full extent of the ravages of the birds in the spring, but also that the first lot may mature in the fall before the birds return, and the second after they have passed on to their winter home. But it frequently happens that one of the crops is 'in the milk' when the birds arrive in August, in which case it is almost impossible to save it from total destruction.

Mr. Allen C. Zard, of White Hill, S. C., says that when rice is so planted as to 'meet the birds,' that is, to be in just the right stage of maturity when they arrive, and they come in full force, they will destroy the whole crop in spite of powder and shot or anything else.

As a sample of actual loss, the following statement, furnished by Colonel Screven, gives his account with the bobolink at Savannah, Ga., for the year 1885:

Cost of ammunition	$245.50
Wages of bird minders	300.00
Rice destroyed, say 400 bushels	500.00
	$1,045.50

Colonel Screven cultivated in that year 465 acres of tidal land, so that he has estimated a loss of less than 1 bushel of rice to the acre, while most of the rice growers estimate the loss at from 4 to 5 bushels.

Captain Hazzard states that in cultivating from 1,200 to 1,400 acres of rice, he has paid as much as $1,000 for bird-minding in one spring.

In addition to the use of firearms, various other methods of avoiding the ravages of the ricebirds have been tried, but with, at best, indifferent success. To prevent the birds from pulling up the sprouted seed in spring the device of coating it with coal tar has been used, as is effectively practiced in the case of corn. But the method of rice culture is very different from that of corn. As soon as the rice is sown it is covered with water, which remains on the field until the germination of the seed, a period of variable length. The soaking in water so affects the tar coating that it no longer protects the grain, and when the water is withdrawn the birds at once attack the seed. Moreover, it is stated by Captain Hazzard that some birds, including the ricebird, hull the grain before eating it, an assertion apparently corroborated by the absence of hulls in the bobolink stomachs examined that contained rice. (When seeds are swallowed by birds, the hulls usually remain longer in the stomachs than the kernels.) Hence, on this account also, the tar coating would probably have no preventive effect. Another method is to attach small flags to stakes or to fly kites over the fields. Looking-glasses have also been suspended in the same way, but all these devices soon cease to be effective. Placing pieces of refuse meat on poles about the fields to attract the buzzards has been tried; the ricebirds mistake the buzzards for hawks and avoid the fields over which they are flying. But the scheme is effective only for a short time, as the birds soon become accustomed to the presence of the buzzards and pay no further attention to them.

These facts and figures are presented for the consideration of the people of the Northern States, to whom the name 'bobolink' suggests only poetry and sentiment, and by whom the birds themselves are looked upon as almost sacred, and are rigidly protected. It is not probable that any farmer in the North will for a moment contend that he receives from the bobolinks that nest upon his farm so much benefit that he would be willing in return to share the losses inflicted upon his Southern brothers by the birds.

Insect pests ravage the crops of the whole country. No section is exempt from damage. Each crop has its destroyers, against which human energy and science must contend with whatever success they may, and in most cases some effectual remedy has been devised. But the case of the attacks of the bobolink upon the rice crop of the South is unique and is probably the result of a peculiar combination of causes.

As before stated, these birds are inhabitants of open fields; meadows and prairies form their ideal breeding grounds. So much do they avoid woods and groves that they will seldom nest in a well-grown orchard, even if other accompaniments are agreeable. At the time

America was first settled, the whole northeastern part of the country must have presented but few localities, and those of limited area, suited to their wants. When the great forests of New England and New York were cleared away and transformed into farms with extensive areas of mowing land intersected with springs and brooks, the bobolinks were not slow to avail themselves of these new opportunities and soon colonized the whole. At the same time the southeastern coast region was also brought under cultivation, and the tidal and river lands were devoted to the raising of rice, thus furnishing the food needed for the augmented numbers, as noted by Wilson. As settlement, with its attendant clearing away of forests, spread westward, suitable nesting areas were continually added to those already created, and the birds had abundant opportunity for great increase in numbers.

Since the bobolinks pass the winter in South America, the southern coast of Florida naturally presents to most of them the point of departure for the long sea flight to their winter homes. Before reaching this spot, however, they stop to rest and feed in the rice fields of the Southeast, where they remain and recruit their exhausted energies preparatory to final migration. A small contingent, representing those that have nested in the extreme western portion of their range, migrate directly down the Mississippi Valley to the rice fields of Louisiana. When the birds arrive from the North they are in poor condition, having been debilitated by the exertion of reproduction, but they at once begin to recuperate with the abundant food furnished by the rice, soon become very fat, and, after a few weeks' rest, are able to safely resume the southern journey. On the return migration the conditions are similar; the birds arrive from their winter home tired out with their long flight, and find the fields either newly sown with rice or else with the tender blade just appearing above the ground. In each case there is an abundant supply of food, and they are soon in condition to pursue the journey to their northern breeding ground.

Here we see the two causes which have combined to bring about all the trouble between the rice planters and the bobolinks: (1) The fact that the species has probably much increased through the extension of its northern breeding ground, and (2) the fact that the rice fields lie directly in the path of migration, and afford a convenient place for rest and recuperation before and after the flight across the sea. It is almost certain that if the rice fields were far outside of the lines of migration, they would never be molested. It is probable that long before America was discovered the bobolinks gathered in the marshes on the southeastern coast and fed upon wild rice and other wild plants previous to departure for their winter home. Cultivation of the land introduced a more abundant supply of food in the South just at the time it afforded a great increase in nesting area in the North.

In view of the fact that the food habits of the bird during migration are well known, attention has been directed chiefly in the present laboratory investigation to the character of the food taken on the breeding grounds. Of 291 stomachs examined (see p. 72), 231 were obtained from various points in the North, embracing nineteen States, from Massachusetts to Montana, the District of Columbia, and Ontario. They were taken in the five months from May to September, inclusive, but the majority of the September birds whose stomachs have been examined may be regarded as belated migrants. The food for these five months was found to consist of 57.1 percent animal matter and 42.9 percent vegetable. This result would be rather surprising but for the fact that only two of the May and nine of the September stomachs were collected in the rice fields. The general character of the food during the five months is shown in the accompanying diagram (fig. 2).

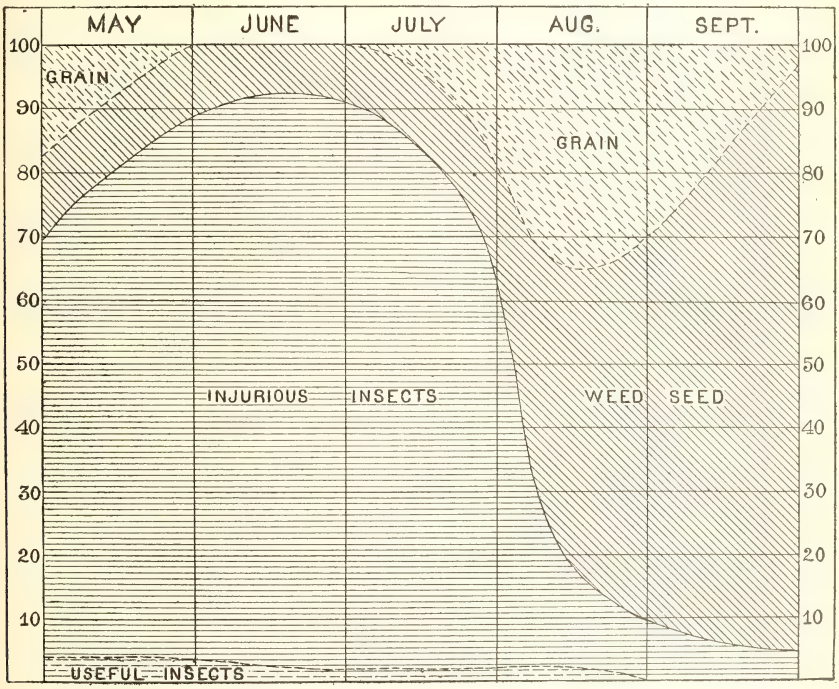

FIG. 2.—Diagram showing proportions of animal and vegetable food of bobolink in each month from May to September inclusive. (The figures in the margins indicate percentages.)

Of the insect food, as determined by the examination, beetles constitute nearly 19 per cent. Predaceous species (Carabidæ), which are, broadly considered, useful insects, are represented only by a trace; snout-beetles, or weevils (Rhynchophora), amount to 8.9 percent, and in May to 20.8 percent; and other beetles, of various families, and all

of a more or less harmful character, make up the rest of the coleopterous food. Hymenoptera, represented by ants and some wasps, and by many of the small parasitic species, form 7.6 percent of the food, and were found mostly in May and July stomachs. The bobolink eats more of these useful parasitic Hymenoptera than any other bird whose food habits have thus far been investigated, although it should be stated that examinations of flycatchers and other birds now in course of completion indicate that it will soon lose its position at the head of the list. Caterpillars are apparently a favorite food. They form 17.6 percent of the May food, and rise to 28.1 percent in June, after which they gradually decrease, averaging in the five months 13 per cent. Those eaten are mostly of the species known as cutworms, and include the well-known *Nephelodes violans*. Grasshoppers constitute 11.5 percent of the food, and are eaten principally in June and July, when they amount to 23.2 and 25.8 percent respectively. This is unusual. There seems to be a pretty general law that all birds, no matter what their food habits may be during the rest of the year, eat grasshoppers in August, just as the human race eats certain delicacies in their respective seasons. But in August, when with most birds the grasshopper season is at its height, the bobolinks begin to drop their animal diet and eat vegetable food in preparation for the rice season in the South. Besides the insects already mentioned, a few bugs and flies are eaten, and also some spiders and myriapods.

Of the vegetable food, 8.3 percent consists of oats, most of which are consumed in August, when they reach 31.4 percent of the whole food for the month. Besides oats and rice, little grain is eaten. Wheat and barley were found in a few stomachs, and buckwheat in one. Corn was not found. Weed seeds, such as barngrass, panicgrass, smartweed, and ragweed, are eaten to the extent of 16.2 percent of the food, and like oats are taken mostly in August, when they amount to 36.9 per cent. Various other articles of vegetable food go to make up the diet of the bobolinks, while they remain in the North, the most important of which is wild rice, which seems to be the favorite food during the journey to the rice plantations. This plant is as aquatic as its cultivated relative, and abounds along all the bays, estuaries, and rivers of the Atlantic coast, where it affords food for millions of birds of many species in the latter part of August and during September and later. It was originally, no doubt, the principal food of the bobolinks at this season, and remained so until the advent of civilization introduced something that the birds found even more to their taste. Of the two birds taken in the rice fields in May, one had eaten 55 percent of insects and 45 percent of rice, with a trace of weed seed, while the other had eaten 50 percent of insects, 25 percent of rice, and 25 percent of weed seed. Of the insects, 41 percent in one stomach and 30 in the other were snout-beetles (Rhynchophora). The remainder were harmful beetles of other kinds and

caterpillars, except 3 percent of predaceous beetles (Carabidæ) in one stomach and 15 percent of parasitic Hymenoptera (Ichneumonidæ) in the other. Of the nine birds shot in the rice fields in September, one had eaten 15 percent of insects and another 90 percent. The other seven had taken no animal matter, but one had eaten 10, and another 70 percent of weed seed (*Rumex*). All the other food, about 79 percent of the whole, was rice.

SUMMARY.

In a summary of its food habits this species must be treated differently from other birds. It is not enough merely to sum up the noxious insects and weeds destroyed and set them on one side of the account, with the valuable grain eaten on the other, and then strike a balance; though even in this case we should probably decide against the bird, or at least be forced to say, as of the redwing, that its harmfulness is due to an excess of individuals. The case of the bobolink is peculiar. If it preyed upon all kinds of grain or upon any one kind whose cultivation was more general, like wheat or oats, its ravages would be more widely distributed and would consequently fall less heavily upon the individual cultivator; and the damage, although the same, would be more evenly divided and so less appreciated. But instead of this, the attacks of the whole species are directed upon a single crop, and one which is grown over a very limited area and by comparatively few cultivators. Again, unlike most species that remain in the South during the winter and subsist to a great extent upon scattered waste grain, the bobolink makes its attacks at planting time and at or immediately before the full tide of harvest—just when it is capable of doing the greatest damage. The redwing, although it eats rice at harvest, remains through the winter, eating the waste rice, which, if left upon the field, would become what is called 'volunteer' rice—an undesirable element of the crop; but the bobolink in its relations to the rice field has not a single redeeming trait. What aggravates the case is the fact that the birds do not need the rice. There is no reason to suppose that if rice culture were entirely abandoned there would be any diminution in the number of bobolinks. It is altogether probable that if this source of food were withdrawn there would be enough other seed-bearing plants to supply their needs. Bird food is almost always superabundant. It is only under very exceptional circumstances that birds suffer seriously from hunger.

What, then, shall we say of the bobolink? In the life of the writer this bird is associated with some of the happiest and brightest hours of childhood, youth, and maturity. A sunny June morning in rural New England would hardly be complete without the bubbling, gushing, rollicking melody of the bobolink in the mowing lot. But hard

facts can not be set aside by poetry and sentiment. The picturesqueness of the bobolink and the melody of its song do not offset the financial loss and harassing care of the Southern rice growers. As the case stands at present the harm done by the bird far outweighs its benefits; but it is to be hoped that science may devise some means by which the rice growers may be relieved from some portion, if not all, of the labor and expense now incident to saving their crops from its devastations.

The following table shows the percentage of each of the principal kinds of food for each month from May to September.

Food of the bobolink.

[NUMBER OF STOMACHS EXAMINED: May, 52; June, 41; July, 45; August, 103; September, 50. Total, 291.]

Food.	May.	June.	July.	August.	September.	Average.
ANIMAL.	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*
Predaceous beetles	1.0	0.7	.....	1.3	.....	0.6
May-beetle family	12.1	1.5	.....	[1] Tr.	.....	2.7
Snout-beetles	20.8	9.6	9.6	2.5	2.2	9.0
Other beetles	8.6	12.8	10.7	1.4	0.1	6.7
Wasps, ants, etc	15.5	5.0	13.6	3.5	0.3	7.6
Caterpillars	17.6	28.1	15.3	2.3	1.8	13.0
Grasshoppers	[1] Tr.	23.2	25.8	6.0	2.5	11.5
Other insects	3.5	9.0	8.4	2.0	0.2	4.6
Spiders and myriapods	2.8	2.5	1.1	0.4	.....	1.4
Total animal food	81.9	92.4	84.5	19.4	7.1	57.1
VEGETABLE.						
Oats	5.3	.....	3.4	31.4	1.6	8.3
Other grain	1.7	.....	0.1	4.3	14.6	4.1
Weed seeds	10.0	6.4	9.6	36.9	18.1	16.2
Other vegetable food	1.1	1.2	2.4	8.0	58.6	14.3
Total vegetable food	18.1	7.6	15.5	80.6	92.9	42.9

[1] Tr. = trace.

THE COWBIRD.

(*Molothrus ater.*)

Few rural sights are more suggestive of quiet enjoyment than a group of cows lying at ease in a sunny pasture calmly chewing the cud, while on their backs a small flock of cowbirds are resting or walking slowly about searching for food. Why the birds choose such companions is difficult to explain, as there does not appear to be any special relation between them, but their association with domesticated animals is a matter of common observation, and has given rise to their popular name. Both Audubon and Wilson ascribe the habit to the desire of the birds to feed upon the intestinal worms they find in the cow droppings.[1] But stomach examination, however, entirely fails

[1] Ornith. Biog., Vol. I, p. 498, 1831. Am. Ornith., Edinburgh ed., Vol. I, p. 209, 1831.

to bear out this supposition. The insects that annoy the animals do not constitute any considerable portion of the cowbird's food, nor are the seeds upon which it subsists found to any particular extent where cattle range. As the cowbird is abundant in the Mississippi Valley and on the Great Plains, it would be interesting to know if it formerly associated on familiar terms with the buffalo, and such would seem to be the case, as Major Bendire gives 'buffalo bird' as one of its former names.[1]

The cowbird ranges from the Atlantic to the Rocky Mountains and sparingly beyond nearly to the Pacific, and from the Gulf of Mexico northward into southern Canada. It breeds throughout its range, except in the immediate vicinity of the Gulf.

In winter most of the birds leave the United States and pass into northern Mexico, but a few remain in the Southern States and stragglers may occasionally be found farther north. The southward movement begins in September, and by November 1 the birds have left the Northern States. On their return in spring they appear in the Middle States in March, and by the first week in May have covered their whole summer range. Their great center of abundance is the Mississippi Valley, where they are among the commonest species and second to few in point of numbers. It is a well-known fact that the cowbird, like the European cuckoo, but unlike most other birds, builds no nest for its eggs and young, but saddles the labor of rearing its progeny upon other species into whose nests it introduces its eggs. The birds it selects for this imposition are mostly species smaller than itself, and such as nest in bushes and hedges, or near the borders of woodland; for as the cowbirds inhabit the open country they will not penetrate the depths of the forest. Most of the birds thus imposed upon accept the charge, however reluctantly, and rear the intruder. As the cowbird's egg usually hatches before the eggs of the owner of the nest, the young cowbird begins at once to grow and crowds out, or prevents further incubation of, the other eggs; or, if they are hatched, so monopolizes the food supply that the young soon perish of starvation. This has been observed many times, but whether it is the universal rule has not yet been demonstrated. It is supposed that a female cowbird deposits but one egg in a nest, and that where more than one strange egg is found they are the product of different birds. As many as seven cowbird eggs have been found in one nest. A few birds actively resent the intrusion of the strange egg, and either desert the nest entirely, or build up its sides and lay a new floor, beneath which the unwelcome present is left to decay. This device has, in some cases, been used twice in the same nest, a three-storied structure resulting, in the upper story of which the rightful occupants were finally reared. The sparrows, warblers, and flycatchers are the

[1] Rept. U. S. National Museum for 1893, p. 591, 1895.

species most frequently imposed upon, but occasionally larger ones are victimized. Major Bendire enumerates 90 species in whose nests the cowbird's eggs have been found. The largest of these are the mourning dove (*Zenaidura macroura*) and the meadowlark (*Sturnella magna.*)[1] That this parasitic habit is injurious to other species there is no reason to doubt, but the extent of the injury has never been accurately determined.

It was partly with the expectation of finding some points in the cowbird's character to offset, to some extent, its parasitism that an investigation of its food habits was undertaken. The subject of its food has not attracted much attention from writers upon ornithology; for no great destruction of grain crops has been reported against the cowbird, nor has it ever been accused of preying appreciably upon fruit or garden produce. Dr. B. H. Warren, one of the few ornithologists to make a detailed examination of its food, says:

> The food of these birds consists of seeds, grains, berries and insects. Although Cowbirds subsist to a small extent on wheat and rye, they never, I think, * * * attack these cereals when growing. The seeds of clover, timothy, fox-tailed grass, bitter-weed, etc., are included in their bill of fare; blackberries, huckleberries, cedar berries, wild cherries and the summer grape (*Vitis æstivalis*, Mz.) are eaten. They subsist to a very great extent, however, on insects; large numbers of grasshoppers, beetles, grubs and "worms" are eagerly devoured.[2]

Maj. Bendire enumerates, as among the articles of cowbird diet, ragweed, smartweed, foxtail or pigeon grass, wild rice and the smaller species of grains, berries of different kinds, grasshoppers, beetles, ticks, flies, and other insects, worms, etc., and adds: "Taking its food alone into consideration it does perhaps more good than harm."[3]

A collection of 544 stomachs has been received by the Biological Survey from twenty States ranging from Maine south to Virginia and west to Kansas and the Dakotas, and also from Tennessee, Georgia, Texas, Arizona, the District of Columbia, and Canada (see p. 73). Every month in the year is represented, though only three stomachs were taken in January. The total food found in these stomachs was divided as follows: Animal matter, 22.3 percent; vegetable, 77.7 percent. The proportions in different months are shown by the accompanying diagram (fig. 3). Only a little more than 3 percent of the stomach contents was sand or gravel—a very small amount when the large proportion of vegetable food is considered. The animal food consists almost entirely of insects and spiders, a few snails forming the exceptions. The insects comprise wasps and ants (Hymenoptera), bugs (Hemiptera), a few flies (Diptera), beetles (Coleoptera), grasshoppers (Orthoptera), and caterpillars (Lepidoptera). Wasps, ants, and flies,

[1] Rept. U. S. National Museum for 1893, p. 594, 1895.

[2] Birds of Pennsylvania, revised ed., p. 210, 1890.

[3] Life Histories of N. A. Birds, II, Special Bul. No. 3, U. S. National Museum, p. 435, 1895.

especially the last, are the insects that might be supposed to attract the birds to the cattle, but the stomachs do not show that many are eaten, for altogether they amount to less than 3 percent of the food, and the wasps and ants are the most important constituents of this percentage. The wasps are probably picked from flowers while gathering honey and the ants are collected from the ground. The destruction of the latter is a decided benefit and the former can be spared. Hemiptera are represented in the stomach by stink-bugs (Pentatomidæ), leaf-hoppers (Jassidæ), and one cicada. While some of the pentatomids are useful insects, because of their habit of preying upon others of a noxious character, many of them are serious

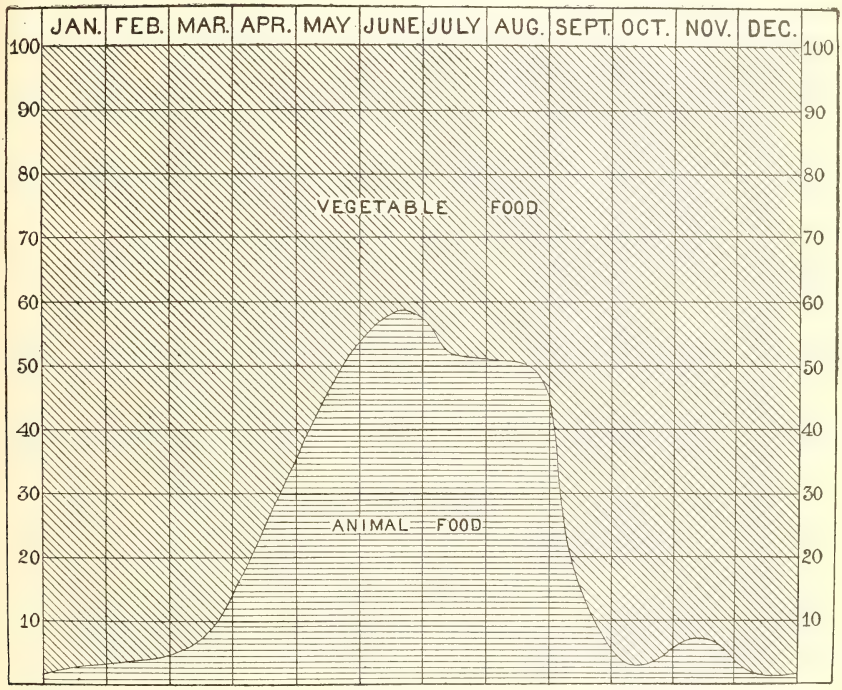

FIG. 3.—Diagram showing proportions of animal and vegetable food of cowbird in each month of the year. (The figures in the left margins indicate percentages.)

pests; so on the whole it is probable that birds do little harm by eating them. The so-called leaf-hoppers live to a great extent upon grass and might very properly be called grasshoppers were it not that that name has been appropriated for other insects. Those eaten are so little that it would require a number of them to fill the stomach of even a small bird. All are harmful, and some, as for example those that feed on the grapevine and rose, are very injurious. Cowbirds eat a great many of these leaf-hoppers, which in some stomachs amount to 60 percent of the whole contents. The greater number are eaten in June and July, but the aggregate for the year is small, about 1½ percent.

Beetles form 5.3 percent of the year's food. The predaceous ones, or those that prey to a greater or less extent on other insects (Carabidæ and a few Cicindelidæ), although living on the ground and often found by cowbirds, are rarely eaten, the aggregate for the year being about three-fourths of one percent of the whole food. Of the eight families of beetles represented in the food, only one group, the snout-beetles or weevils (Rhynchophora), are eaten to any noticeable extent, and these amount to little more than 2 percent of the food of the year, although in June they rise to more than 9 percent. They belong mostly to the families of scarred snout-beetles (Otiorhynchidæ), curculios (Curculionidæ), and 'bill bugs' (Calandridæ), and as they are all potentially harmful and most of them actual pests, their destruction is a benefit to agriculture. The rest of the beetle food, comprising species that are all more or less injurious, amounts to a little more than 2 percent, and is taken chiefly in April, May, and June.

Grasshoppers appear to be the cowbirds' favorite animal food, and compose almost half of the insect food, or 11 percent of the whole. They are first taken in March, when the birds return from their winter home, reach a maximum of 45.1 percent in August, and decrease to 6.2 percent in November. This is a large record, compared with those of most other birds whose food has been accurately determined. It is much greater than those of the crow, crow blackbird, or red-winged blackbird, all noted ground feeders, and is exceeded only by those of the meadowlark and a few of other families.

Caterpillars are eaten to some extent in every month of the cowbirds' stay in the North, but do not constitute a very important element of the food, averaging only a little more than 2 percent of the whole. The greatest number, amounting to a little more than 10 percent, are eaten in May. The notorious army worm (*Leucania unipuncta*) was identified in four stomachs, and was probably contained in many more, but not in a condition to be recognized. One small moth and one ephemerid were also found.

Spiders were found in many stomachs, but not in large numbers. They seem to be eaten wherever they are found, but probably only terrestrial species are taken. Snails were found in a number of stomachs.

Eggshells occurred in several stomachs, but in such small quantities as to preclude the probability that they were taken from the nests of other birds. When young birds are hatched the parents remove the eggshells and drop them at some distance from the nest, where, doubtless, they are found and eaten by other birds, for bits of eggshell appear more or less frequently in the stomachs of nearly every species examined.

The vegetable food of the cowbird exceeds the animal food, both in quantity and variety. When searching the ground about barnyards or roads the bird is evidently looking for scattered seeds rather than insects, though the latter are probably taken whenever found. Various

other substances are also eaten, but they are mostly of the same general character, such as hard seeds of grasses or weeds, with but little indication of fruit pulp or other soft vegetable matter. The following table shows the various grains and seeds identified, with the number of stomachs in which they were contained:

Vegetable substances found in stomachs of cowbirds.

	Stomachs.
Grain:	
Corn	56
Wheat	20
Oats	102
Buckwheat	1
Fruit:	
Blueberry (*Vaccinium*)	1
Raspberry (*Rubus*)	4
Forage:	
Clover (*Trifolium*)	8
Timothy (*Phleum*)	8
Sorghum (*Andropogon sorghum*)	2
Weeds:	
Ragweed (*Ambrosia*)	176
Knotweed (*Polygonum*)	49
Sorrel (*Rumex*)	37
Thistle (*Carduus*)	1
Amaranth (*Amaranthus*)	11
Mustard (*Brassica nigra*)	4
Chickweed (*Alsine*)	9
Weeds—Continued.	Stomachs.
Pennyroyal (*Trichostema dichotomum*)	2
Mouse-ear chickweed (*Cerastium*)	2
Plantain (*Plantago*)	1
Sunflower (*Helianthus*)	8
Gromwell (*Lithospermum*)	4
Blue-eyed grass (*Sisyrinchium bermudiana*)	1
Barngrass (*Chætochloa*)	265
Panic-grass (*Panicum*)	133
Joint-grass (*Paspalum*)	22
Yard-grass (*Eleusine indica*)	2
Unidentified (mostly unknown grass seeds)	57
Miscellaneous:	
Mast	1
Leaf gall	2
Rubbish	5

Oats are apparently the favorite grain with the cowbird, as they were found in 102 stomachs, a record which exceeds the total of those containing either wheat or corn. They first appear in March, when 12.9 per cent are eaten, evidently waste grain picked up in the stubble-fields, highways, and barnyards, except in the southern part of the country, where sowing may take place as early as this month. Oats constitute less than 2 per cent in April, nearly 8 percent in May (probably partly made up of grain from newly sown fields), 3.7 in June, 25.1 in July, 31.5 in August, 19.4 in September, and after that decrease rapidly and reach zero before the 1st of November. The average consumption for all the months of the year is 8.6 percent. Corn was found in 56 stomachs, but the irregular manner in which it is distributed through the food of the year indicates that it is not a favored diet. The record for January, which shows a little more than 33 per cent, is based on only 3 stomachs, and so can not be considered very reliable. In any case the corn eaten must have been scattered grain, unless it was some that had been left in the shock over winter. Even in October, when corn is abundant everywhere, it is scarcely touched. Only 1 bird out of 70 taken in that month had eaten any, and in this single instance it amounted to only 6 percent of the entire food. In the other months the quantity ranges downward to zero, but in such an erratic manner as to indicate that it is never sought, but merely eaten when found and when better food is not at hand. The

aggregate for the year is 6.5 percent. Wheat was found in only 20 stomachs, and amounts to 1.4 percent of the year's food. Like corn, its distribution is irregular and does not appear to have any relation to the seasons. It is probable that it is a purely accidental food, eaten only when nothing better is to be had. The greatest quantity (4.8 percent) was taken in September. A single kernel of buckwheat was found in 1 stomach.

Grain as a whole amounts to 16.5 percent, or practically one-sixth of the food of the year; but a consideration of its distribution as given above leads to the conclusion that a large portion of this, probably one-half, is waste. In comparing the record of the cowbird with that of the red-winged blackbird, the cowbird's shows the greater consumption of grain; that is, 16.5, as against 13.9 for the redwing. In view of this fact it would seem somewhat strange, were not a large proportion of the grain consumed waste, that no complaints should have been made against the cowbird on the score of grain eating. It is possible, of course, that observers have not always distinguished the two species in the field, as male cowbirds do not differ greatly in color or size from female redwings—and their great abundance in the West lends some color to this supposition. But it seems far more probable that they gather a very important part of the grain found in their stomachs in their gleaning in roads, about barnyards, and wherever cattle are found, and so do far less actual damage to growing crops than the redwings.

Fruit forms an insignificant part of the food. Some traces of what may have been fruit pulp were found, and a few seeds of raspberries were in each of 4 stomachs, and some blueberry seeds in one; but as some of the raspberry seeds were in stomachs collected in April they were evidently eaten as dry seeds, and this may have been true of all.

The seeds of plants classified as weeds in the list of vegetable food constitute by far the most important part of the diet. They form the largest item of food in every month except July and August, and are of importance in every month. Beginning with 64.4[1] percent in January and 95.5 percent in February, they slowly decrease to 16.6 percent in August, but rise suddenly to 58.1 percent in September, attain their maximum of 97 percent in October, and end with 96.8 percent in December. They constitute practically the whole food of the winter months. The aggregate for the year is 60 percent of all the food, or more than three-fourths of the vegetable food, and more than three and a half times the total amount of grain. Barngrass and ragweed are especially well known as troublesome weeds throughout the country wherever field crops are cultivated, and these two constitute the great bulk of this food. Barngrass seed was found in 265 stomachs and ragweed in 176. Panicums, while ostensibly forage plants, are often troublesome weeds. Their seeds were found in 133

[1] Based on 3 stomachs. A larger number would probably greatly increase the percentage.

stomachs, which shows that the birds relish them. Knotweed, smartweed, and other species of the genus *Polygonum*, all noted weeds, were found in 49 stomachs. The other items of the weed-seed food are eaten to a greater or less extent, but not by so many birds as are those specifically mentioned. Of the 544 stomachs only 2 were filled with grain alone, while 94 contained nothing but weed seed. The amount of weed seed destroyed by birds in a single year in the United States is immense, and it is evident that the cowbird is one of the noteworthy agents by which the already overflowing tide of noxious weeds is kept within its present limits.

SUMMARY.

In summing up the results of the investigation, the following points may be considered as fairly established: (1) Twenty per cent of the cowbirds' food consists of insects, which are either harmful or annoying. (2) Sixteen per cent is grain, the consumption of which may be considered a loss, though it is practically certain that half of this is waste. (3) More than 50 per cent consists of the seeds of noxious weeds, whose destruction is a positive benefit to the farmer. (4) Fruit is practically not eaten.

The following table shows the percentage of each of the principal kinds of food for every month in the year:

Food of the cowbird.

[NUMBER OF STOMACHS EXAMINED: January, 3; February, 10; March, 18; April, 83; May, 99; June, 53; July, 57; August, 38; September, 79; October, 70; November, 23; December, 11. Total, 544.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Predaceous beetles	.....	.....	.....	1.1	3.9	1.6	1.5	.....	.....	.....	.....	0.4	0.7
Other beetles	0.3	2.4	2.4	10.2	12.3	16.5	8.1	1.7	0.8	0.1	[1]Tr.	.....	4.6
Grasshoppers	.....	.....	2.9	5.8	10.7	20.3	29.7	45.1	9.4	1.8	6.2	.....	11.0
Caterpillars	1.3	1.3	2.1	5.2	10.3	3.8	2.2	0.3	0.3	[1]Tr.	.....	.....	2.2
Other insects	0.7	0.6	1.0	0.8	2.4	9.8	7.2	2.4	2.2	[1]Tr.	0.1	0.3	2.3
Spiders and myriapods	.....	0.2	.....	2.5	2.2	4.8	2.9	0.9	0.3	[1]Tr.	.....	.....	1.1
Other animal food	.....	.....	0.2	0.1	0.9	2.3	0.5	0.1	[1]Tr.	.....	.....	.....	0.4
Total animal food	2.3	4.5	8.6	25.7	42.7	59.1	51.9	50.5	13.0	1.9	6.3	0.7	22.3
VEGETABLE.													
Grain	33.3	.....	31.3	7.1	15.7	12.9	27.2	31.7	28.9	1.1	6.1	2.5	16.5
Weed seeds	64.4	95.5	49.1	66.1	41.5	28.0	19.2	16.6	58.1	97.0	87.6	96.8	60.0
Other vegetable food	.....	.....	11.0	1.1	0.1	.....	1.7	1.2	.....	.....	.....	.....	1.2
Total vegetable food	97.7	95.5	91.4	74.3	57.3	40.9	48.1	49.5	87.0	98.1	93.7	99.3	77.7

[1]Tr. = trace.

In view of the fact that so much has been said in condemnation of the cowbird's parasitic habits, it may not be out of place to inquire whether this parasitism is necessarily as injurious as has been claimed. When a single young cowbird replaces a brood of four other birds, each of which has food habits as good as its own, there is, of course, a distinct loss; but, as already shown, the cowbird must be rated high in the economic scale on account of its food habits, and it must be remembered that in most cases the birds destroyed are much smaller than the intruder, and so of less effect in their feeding, and that two or three cowbird eggs are often deposited in one nest.

The question is a purely economic one, and until it can be shown that the young birds sacrificed for the cowbirds have more economic value than the parasite, judgment must be suspended.

THE YELLOW-HEADED BLACKBIRD.

(*Xanthocephalus xanthocephalus.*)

The yellow-headed blackbird is locally distributed throughout the Western United States, where it frequents marshes and sloughs, but avoids the more arid deserts, extensive forests, and wooded mountains. Its range in summer extends from southern California through northern Arizona and New Mexico to Indiana, and northward into the Canadian Provinces. It winters in the southern part of its range and on the table-lands of Mexico. Stragglers have been found from Greenland to Cuba.

Its breeding habits are much like those of the redwing, but it is usually less abundant than that bird. It is gregarious and resorts to marshes to build its nest, which is very similar to that of the redwing, and similarly placed. Although it breeds in marshes, it does not by any means confine itself to them in its search for food, but forages far afield, visiting cornerib, grainfields, and barnyards. The writer's first experience with the yellow-headed blackbird was on the prairies of Nebraska, where flocks visited the railway then in process of construction, running about among the feet of the mules and horses in search of grubs and worms exposed by the plow and scraper, and all the time uttering their striking gutteral notes (almost precisely like those of a brood of suckling pigs). In their habit of visiting barnyards and hog pastures they resemble cowbirds much more than redwings. When the breeding season is over they often visit grainfields in large flocks, and become the cause of much complaint by Western farmers.

The investigation of their food is founded upon an examination of 138 stomachs received from ten of the Mississippi Valley States, and from California and Canada, and collected during the seven months from April to October, inclusive (see p. 73). While decidedly too few to give entirely reliable results, they may furnish some preliminary

data regarding the food. As indicated by the contents of these stomachs, the food for the seven months consists of 33.7 percent of animal (insect) matter and 66.3 percent of vegetable matter. The animal food is composed chiefly of beetles, caterpillars, and grasshoppers, with a few of other orders, while the vegetable food is made up almost entirely of grain and seeds of useless plants. Predaceous beetles (Carabidæ) constitute 2.8 percent of the season's food, a very small amount for a bird of such pronounced terrestrial habits. Most of these beetles are eaten in May, June, and July, and none are taken in the fall months. Other beetles amount to a little more than 5 percent, and are eaten mostly in the early part of summer. Caterpillars constitute 4.6 percent, but nearly two-thirds of them are taken in July, and in that month they form 21.5 percent of the month's food. Remains of the army worm (*Leucania unipuncta*) were identified in 6 stomachs. Grasshoppers are first eaten in May, but do not amount to any important percentage until July, the month of maximum consumption. In this respect this bird appears to differ, like the bobolink, from most other species, as August is usually the month in which grasshoppers are eaten most freely; but the examination of a larger number of stomachs might prove the yellowhead to be no exception to the usual rule. After August the consumption of grasshoppers is considerably increased, and the total for the season is 11.6 percent. The remainder of the animal food, 9.7 percent, is made up of other insects, chiefly Hymenoptera (ants, wasps, etc.), with a few dragonflies and an occasional spider and snail.

So far as its animal food is concerned, the yellowhead has a very good record. For a ground feeder, it takes very few predaceous beetles, while insects harmful to vegetation constitute 30 percent of its food.

The vegetable food consists almost entirely of seeds, and for economic purposes may be divided into grain and weed seed. Of grain, oats hold first place, as in the food of the redwing, and are probably eaten in every month when they can be obtained, although none were found in any of the 5 stomachs taken in September. The 3 October stomachs contained an average of 63 percent, but a greater number of stomachs would in all probability give a smaller average. August, apparently the next month of importance, shows 43.2 percent. Next to oats corn is the favorite grain, and was eaten to the extent of 9.8 percent, nearly all in the months of April, May, and June, with a maximum of 48.8 percent in April, when no wheat was eaten. Wheat appears from May to August, inclusive, and is the only vegetable food that reaches its highest mark in August. The average for the season is 3.5 percent.

Grain collectively amounts to 38.9 percent, or considerably more than half of the total vegetable food, and more than one-third of all

the food. While there is no doubt that a considerable quantity of this is waste, still a very decided taste for grain is shown, a point that is more especially emphasized by the large quantity (more than 54 per cent of the total food) eaten in August. Corn, from its appearance in such large quantities in the food of the early spring months, is evidently picked up as waste grain to a considerable extent, but oats and wheat, which appear at the same time, are probably largely taken from newly sown fields. In July and August they evidently come from harvest fields. Mr. E. W. Nelson, of the Biological Survey, informs the writer that from about the last of August to the end of September the cornfields of the table-lands of Mexico are much damaged by yellowheads.

Weed seed appears as a very prominent item of food in every one of the seven months under consideration, except October, the record for which is based on only 3 stomachs and hence can not be made a basis for sound conclusions. Beginning with 18 percent in April, it increases to 34 percent in June, drops to 6.6 in July (to make room for caterpillars and grasshoppers), rises to 36.1 percent in August, and finally to 64.4 percent in September. While, as stated above, none was found in the 3 October stomachs, there is no reason to doubt that weed seed is not only a common article of food in that month but also a staple diet in the other colder months of the year. It is to be regretted that no stomachs of the yellowhead have been received from its winter range, to give some idea of its food during the colder season. It is almost certain, however, that this would be found to consist of weed seed and waste grain, as in the case of its neighbor, the redwing. The weeds found in the stomachs are almost precisely the same as those eaten by the redwings, and in practically the same proportions. Barngrass (*Chætochloa*), *Panicum*, and ragweed (*Ambrosia*) are the leading kinds, supplemented by *Polygonum*, *Rumex*, and others.

SUMMARY.

From this brief review some conclusions may be drawn, but the somewhat fragmentary nature of the evidence makes it probable that they may be subject to considerable modification in future. It is almost certain that the rather peculiar distribution of the various items of food through the season will prove to be more apparent than real in the light of more extensive observations. In the meantime we may safely conclude (1) that the yellowhead feeds principally upon insects, grain, and weed seed, and does not attack fruit or garden produce; (2) that it does much good by eating noxious insects and troublesome weeds, and (3) that where too abundant it is likely to be injurious to grain.

When it is considered that the redwing has been accused of doing immense damage to grainfields, it is evident that the yellowhead, which

has been found to eat nearly three times as much grain as the former, must be capable of much mischief in localities where it becomes superabundant.

The following table shows the various elements of the food for each month of the season:

Food of the yellow-headed blackbird.

[NUMBER OF STOMACHS EXAMINED: April, 9; May, 31; June, 14; July, 16; August, 60; September, 5 October, 3: total, 138.]

Food.	April.	May.	June.	July.	August.	September.	October.	Average.
ANIMAL.	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*	*Percent.*
Predaceous beetles	2.7	8.0	4.1	4.7	0.1	.....	.....	2.8
Other beetles	3.9	12.6	7.8	7.8	0.7	.....	2.3	5.0
Caterpillars	0.1	6.0	4.4	21.5	0.1	.....	.....	4.6
Grasshoppers	.....	1.0	0.4	32.0	8.0	15.6	24.3	11.6
Other insects	2.6	5.3	22.6	6.9	0.8	19.0	10.4	9.7
Total animal food	9.3	32.9	39.4	72.9	9.7	34.6	37.0	33.7
VEGETABLE.								
Corn	48.8	9.0	9.7	.....	1.1	.....	.....	9.8
Wheat	.....	5.7	3.4	5.8	9.9	.....	.....	3.5
Oats	23.9	21.9	12.8	14.4	43.2	.....	63.0	25.6
Weed seed	18.0	30.5	34.0	6.6	36.1	64.4	.....	27.1
Other vegetable food	.....	.....	0.7	0.3	.....	1.0	.....	0.3
Total vegetable food	90.7	67.1	60.6	27.1	90.3	65.4	63.0	66.3

THE RED-WINGED BLACKBIRD.

(*Agelaius phœniceus.*)

The red-winged blackbird (otherwise known as the red-shouldered blackbird, swamp blackbird, and American starling), including its various races,[1] inhabits North America from Nova Scotia and Great Slave Lake south to Costa Rica. It breeds throughout its range in the United States and Canada. The typical form is replaced at different places in the southern part of the range by the Bahama, Florida, and Sonoran redwings, but the differences that separate these various subspecies are scarcely appreciable by the casual observer. The bird is curiously restricted in its local distribution by the fact that it nests as a rule only in the immediate vicinity of water, and preferably directly over it. For this reason it is absent from extensive tracts of country either in high mountainous regions or in desert or forest areas. Nests have occasionally been found in perfectly dry situations at a distance from water, but such cases are exceptional.

The prairies of the Upper Mississippi Valley, with their numerous sloughs and ponds, furnish ideal nesting places for redwings, and consequently this region has become the great breeding ground for the

[1] The different subspecies are not considered separately in this bulletin.

species. In many places, especially on the borders of shallow lakes, thousands of acres of rushes and reeds of various kinds afford nesting sites for redwings, yellowheads, and marsh wrens, while myriads of more aquatic species swim in the waters below and nest amid the broken herbage. It is from such breeding grounds that the vast flocks are recruited that make such havoc upon fields of grain and call forth the maledictions of the unfortunate farmer. East of the Appalachian Range the conditions are different. Marshes on the shores of lakes, rivers, and estuaries are here the only sites available for breeding purposes, and as these are more restricted in number and area than the western breeding grounds the species is much less abundant than in the West.

FIG. 4.—Red-winged blackbird.

Like their associates, the marsh wrens, and their neighbors, the bank swallows, the redwings are eminently gregarious, living in flocks for the greater part of the time and breeding in communities which vary in size according to the area of the swamp they occupy. Sometimes these colonies are reduced to a single family, which in such cases usually consists of one male bird with several females and their nests; for this species practices polygamy, a habit noted in the case of only a few species of song birds.

During the winter the redwings are in the South, but may occasionally be found as far north as latitude 40°, and stragglers may occur at any point within their summer range. (A young male was shot by the writer in central Iowa in January, 1879, and one bird whose stomach

is included in this investigation was killed in northern Massachusetts on January 29, 1896.) In their northward migration they begin to appear in the Upper Mississippi Valley about the last of February or during the first half of March, and by the middle of March enter the New England States. On the return journey they begin to leave the more northern portions of their range in September, and the migration is practically complete by the end of October.

Although they arrive from the South at an early date, they are by no means early breeders, for at that time the marshes are desolate wastes of dead and broken-down herbage, and the birds do not build until the new growth is considerably advanced. This involves a delay of several weeks, during which the birds, having taken possession of a marsh where they intend to construct their homes, sit idly about and behave as though time hung heavily upon them. The females usually perch upon the dead vegetation as if watching for the new growth to appear, while their liege lord, with the resplendent insignia of his rank conspicuous on his shoulders, struts about upon some fence or tree and swells his little body, ruffles up his feathers, and by a display of his brilliant colors and a rather poor attempt at singing tries to make the time less wearisome to his patient mates.

Owing to their peculiar nesting habits these birds do not come in contact with the farmers' crops appreciably during the breeding season, since at this time they confine themselves to the immediate vicinity of their marshy homes. After the season of reproduction they assemble in flocks, usually of a considerable size and often immense, and it is at this time that they frequently do serious harm to crops of standing grain. Much testimony has been received by the Department of Agriculture indicating that the damage is sometimes enormous. In letters received from the rice growers in the South the redwing is implicated equally with the bobolink in destroying rice both in spring and fall. It is claimed by some, however, that the redwing is not wholly bad, as it remains in the fields during the winter and eats the 'volunteer' rice, which, if it grew in any considerable quantity, would spoil the crop.

On the other hand, there is considerable evidence that redwings eat a great many insects, and that it is only under exceptional circumstances that they eat grain to an injurious extent. It is noticeable that nearly all complaints against them come from the Mississippi Valley, where the native grasses and weeds of the prairies have been replaced by vast fields of grain. It has also been stated that the greatest damage was done when but few fields of grain had been planted. These afforded a new and easily accessible supply of food of which the birds were not slow to avail themselves; but since the grainfields have increased in area the work of the birds has become more widely distributed, and the damage has not been so apparent.

Wilson, in speaking of the food of the redwing, says:

The whole season of winter, that, with most birds, is passed in struggling to sustain life in silent melancholy, is, with the redwings, one continued carnival. The profuse gleanings of the old rice, corn, and buckwheat fields, supply them with abundant food, at once ready and nutritious. * * * Before the beginning of September, these flocks have become numerous and formidable; and the young ears of maize, or Indian corn, being then in their soft, succulent, milky state, present a temptation that can not be resisted. Reenforced by numerous and daily flocks from all parts of the interior, they pour down on the low countries in prodigious multitudes. Here they are seen, like vast clouds, wheeling and driving over the meadows and devoted cornfields, darkening the air with their numbers. Then commences the work of destruction on the corn, the husks of which, * * * are soon completely or partially torn off; while from all quarters myriads continue to pour down like a tempest, blackening half an acre at a time; and, if not disturbed, repeat their depredations till little remains but the cob and the shriveled skins of the grain; what little is left of the tender ear, being exposed to the rains and weather, is generally much injured. * * *

It has been already stated, that they arrive in Pennsylvania late in March. Their general food at this season, as well as during the early part of summer, * * * consists of grubworms, caterpillars, and various other larvæ, the silent, but deadly enemies of all vegetation, and whose secret and insidious attacks are more to be dreaded by the husbandman than the combined forces of the whole feathered tribes together. For these vermin, the starlings search with great diligence; in the ground, at the roots of plants, in orchards, and meadows, as well as among buds, leaves, and blossoms; and from their known voracity, the multitudes of these insects which they destroy must be immense. Let me illustrate this by a short computation: If we suppose each bird, on an average, to devour fifty of these larvæ in a day, (a very moderate allowance,) a single pair, in four months, the usual time such food is sought after, will consume upward of twelve thousand. It is believed, that not less than a million pair of these birds are distributed over the whole extent of the United States in summer; whose food, being nearly the same, would swell the amount of vermin destroyed to twelve thousand millions. But the number of young birds may be fairly estimated at double that of their parents; and, as these are constantly fed on larvæ for at least three weeks, making only the same allowance for them as for the old ones, their share would amount to four thousand two hundred millions; making a grand total of sixteen thousand two hundred millions of noxious insects destroyed in the space of four months by this single species! The combined ravages of such a hideous host of vermin would be sufficient to spread famine and desolation over a wide extent of the richest and best cultivated country on earth. All this, it may be said, is mere supposition. It is, however, supposition founded on known and acknowledged facts. I have never dissected any of these birds in spring without receiving the most striking and satisfactory proofs of these facts; and though, in a matter of this kind, it is impossible to ascertain precisely the amount of the benefits derived by agriculture from this, and many other species of our birds, yet, in the present case, I can not resist the belief, that the services of this species, in spring, are far more important and beneficial than the value of all that portion of corn which a careful and active farmer permits himself to lose by it.[1]

Audubon, in speaking of this species, says:

The marsh blackbird is so well known as being a bird of the most nefarious propensities, that in the United States one can hardly mention its name, without hearing such an account of its pilferings as might induce the young student of nature to conceive that it had been created for the purpose of annoying the farmer. That it

[1] Am. Ornith., Edinburgh ed., Vol. I., pp. 193–198, 1831.

destroys an astonishing quantity of corn, rice, and other kinds of grain, cannot be denied; but that before it commences its ravages, it has proved highly serviceable to the crops is equally certain. * * *

Their food at this season [spring], is almost exclusively composed of grubs, worms, caterpillars, and different sorts of coleopterous insects, which they procure by searching with great industry, in the meadows, the orchards, or the newly plowed fields. * * * The millions of insects which the redwings destroy at this early season, are, in my opinion, a full equivalent for the corn which they eat at another period.[1]

Of more recent writers, probably Dr. B. H. Warren has made the most extensive researches upon the food habits of these birds. In stating the results of the examination of 25 stomachs, he says:

The redwing * * * destroys large numbers of "cutworms." I have taken from the stomach of a single swamp blackbird as many as 28 "cutworms." In addition to the insects, etc., mentioned above, these birds also, during their residence with us, feed on earth-worms, grasshoppers, crickets, plant-lice and various larvæ, so destructive at times in the field and garden. During the summer season, fruits of the blackberry, raspberry, wild strawberry, and wild cherry are eaten to a more or less extent. The young, while under parental care, are fed exclusively on an insect diet.[2]

N. S. Goss says of the redwings:

During the fall and winter months they assemble in large flocks, and do much damage in the ricefields, and are often more or less injurious to the grains within their summer homes; but the damage they do in the latter case is overbalanced by the destruction of injurious insects, upon which they almost wholly feed during the breeding season; busy hunters of the field and followers of the plow.[3]

Stomach examination does not indicate that the redwings are especially fond of grain. The diagram here given (fig. 5) illustrates the variation in the relative proportions of the more important elements of the food throughout the year. The preponderance of weed seeds over grain or other vegetable food is apparent at a glance. Weed seeds, such as *Chætochloa* (*Setaria*), *Ambrosia*, *Rumex*, *Polygonum*, etc., constitute more than half the food of the year, while grain (nearly half oats) is less than one-seventh. The only varieties of *Chætochloa* that are cultivated extensively are Hungarian grass and millet, but as these are raised to a great extent as forage plants no great harm is done by taking the seed, except when it is newly sown or where the crop is raised for seed alone. The other species are all noxious weeds, and probably the greater part of the *Chætochloa* eaten by birds is from wild plants, which are as much of a nuisance as any of the other weeds when they get into cultivated fields. In the matter of fruit the redwings are almost total abstainers, only on rare occasions tasting a blackberry or some other of the smaller varieties by way of experiment.

[1] Ornith. Biog., Vol. I, pp. 348–349, 1831.

[2] Birds of Pennsylvania, revised ed., p. 212, 1890.

[3] History of the Birds of Kansas, p. 399, 1891.

The increase of vegetable food other than grain and weed seeds during August and September is due to the consumption of wild rice (*Zizania aquatica*), which at this time forms quite an important item.

In their insect diet the redwings do much good, for only a small proportion of the species they eat are beneficial. More destructive snout-beetles (weevils) are eaten by them than by any other birds that the writer has examined, with the single exception of the bobolinks. Other beetles and grasshoppers also constitute an important part of

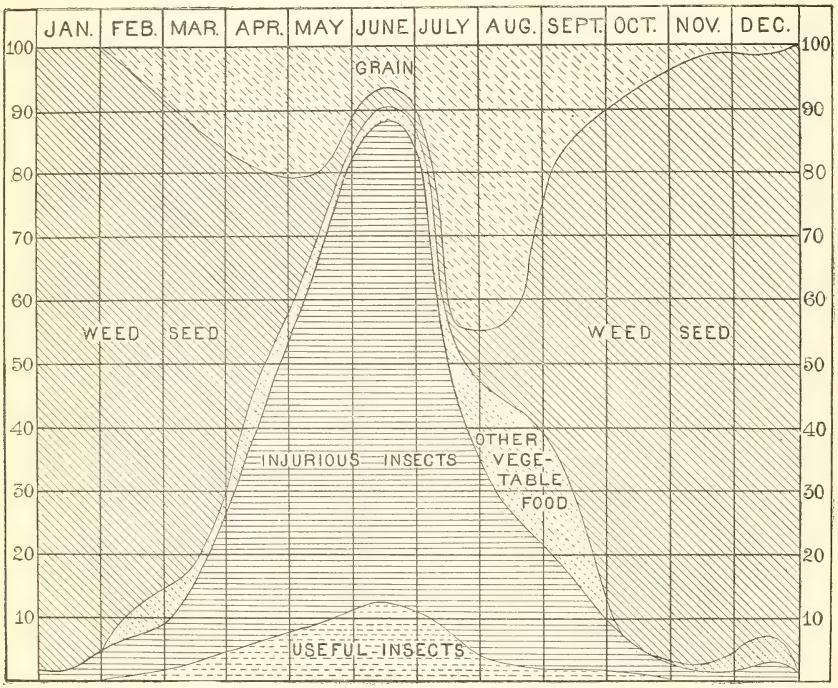

FIG. 5.—Diagram showing proportions of animal and vegetable food of red-winged blackbird in each month of the year. The relative amounts of the different kinds of food are shown by variously shaded areas. Thus, in June, useful insects are represented by the broken-lined area at the bottom of the column for that month, injurious insects by the horizontally shaded space, grain by the space shaded with diagonal broken lines, and the other elements of food in similar manner. The percentage of food (for example, of injurious insects), for a month, is not necessarily indicated by the summit of the curve, but by the space between the upper and lower curves. (The figures in the margins indicate percentages.)

the insect food. While there can be no doubt that the birds do considerable damage when collected in large flocks, it is probable that such injury will become less and less as the area of cultivation increases and the swamps where they breed are encroached upon and drained, with a consequent reduction in the abundance of the species.

The Biological Survey has examined 1,083 stomachs of the redwing, collected in every month of the year, and from thirty States, the District

of Columbia, and Canada (see p. 74). The greater number of these stomachs were collected in the Northern States during and immediately before or after the breeding season. Most of those taken in the South were collected in Texas during the winter. These throw considerable light on the winter food, which does not apparently differ greatly from that eaten in the Northern States in the early spring and late fall. No stomachs were received from the rice-growing region during sowing and harvesting.

The food of the year was found to consist of 73.4 percent of vegetable matter and 26.6 percent of animal. The animal food begins with 1.4 percent in January and gradually increases to 88.2 percent in June, after which it regularly decreases to a fraction of 1 percent in November. With the exception of a few snails and crustaceans, it consists entirely of insects and their allies (spiders and myriapods), so that, roughly speaking, insects constitute one-fourth of the year's food. They consist principally of beetles, grasshoppers, and caterpillars, with a few wasps, ants, flies, bugs, and dragon-flies.

The beetles (Coleoptera) amount to a little more than 10 percent of the food, and the greater part of them are harmful insects. They belong to several families, but only one group is eaten extensively enough to be greatly distinguished above the others. This is the suborder of snout-beetles or weevils (Rhynchophora). These constitute 4.1 percent of the year's food, but in June amount to 22.4 percent of the food of the month. All the beetles of this group are injurious, some of them greatly so. Useful predaceous beetles (Carabidæ) are eaten to the extent of 2.5 percent of the food of the year, but are taken mostly in spring and early summer. Other beetles, belonging to several families, such as click-beetles (Elateridæ), leaf-beetles (Chrysomelidæ), May-beetles (Scarabæidæ), and a few others, amount altogether to 3.5 percent.

Grasshoppers (Orthoptera) are eaten practically in every month of the year, though none were found in the 11 stomachs taken in January. They constitute 4.7 percent of the whole food, and are exceeded by no other insects except beetles and caterpillars. The greatest number (amounting to 17 percent) are eaten in August, the 'grasshopper month.' As all species of grasshoppers are injurious, their destruction must be counted to the credit of the bird.

Caterpillars (larvæ of Lepidoptera) form 5.9 percent of the year's food. They are eaten to a slight extent in the winter months and in gradually increasing amounts up to May, when they form 20 percent of the food. Their consumption falls away to almost nothing in August, when grasshoppers are plentiful, and rises again in September, showing that grasshoppers are preferred, and for a short time replace the lepidopterous food. The same fact has been shown in the case of

the Baltimore oriole, which leaves the trees in August and descends to the ground to eat grasshoppers.[1] While caterpillars are not all harmful, none of them as far as known are doing anything for the good of the farmer, so the redwings, in so far as they destroy these insects, are doing a beneficial work, and among those found in the stomachs were a number of the widely known and dreaded army worm (*Leucania unipuncta*). Miss Caroline G. Soule, in a letter from Brandon, Vt., quoted by Dr. C. M. Weed, says that the redwings, with other birds, do especially good work in destroying the pupæ of the forest-tent caterpillar, and later feed on the adult insects.[2]

Other insects, such as ants and wasps (Hymenoptera), bugs (Hemiptera), flies (Diptera), and dragon-flies (Odonata), with a few spiders and myriapods, make up the rest of the animal food, but none of them are eaten to such an extent as to render them of any striking economic importance. Ants, bugs, and flies are all more or less injurious or annoying insects, while wasps, dragon-flies, and spiders are probably for the most part somewhat useful. Dragon-flies are found about water, where the redwings also live, but they are too rapid in flight and too restless to be caught by anything less expert than a flycatcher, and it is probable that those eaten by redwings are picked up dead. Spiders are for the most part useful, but in a rather restricted way, and their destruction is not a great loss. Considered as a whole, the animal food of the redwings consists of insects, the most of which are positively harmful, while but few are decidedly beneficial.

The diagram on p. 38 shows in a striking manner the increase of the animal food in early summer—that is, in June. It is probable that the exhaustive labors of reproduction call for a more exclusively animal diet in May and June than does the strain of moulting in July and August. There seems to be no other theory by which to explain the decrease in the latter month, especially in view of the fact that these are the months when grasshoppers abound.

The vegetable food of the redwings consists mainly of seeds of grasses and weeds, the different kinds of grain being merely larger or more important grasses. Some of these plants, like wild rice (*Zizania*), have no economic importance; but many others, such as the cultivated grains, are of value, and their destruction is a positive loss; while still others, like ragweed (*Ambrosia*), are noxious weeds, the destruction of which is a benefit to the farmer. The following table shows all the vegetable substances found, with the number of stomachs in which each occurred:

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[1] Yearbook Dept. of Agriculture for 1895, p. 429.

[2] Bull. 64, N. H. Agr. Coll. Expt. Sta., May, 1900.

Vegetable substances found in stomachs of red-winged blackbirds.

	Stomachs.
Grain:	
Oats	190
Corn	117
Wheat	68
Barley	2
Forage:	
Clover (*Trifolium*)	4
Sorghum (*Sorghum*)	5
Timothy (*Phleum*)	7
Weeds:	
Panic-grass (*Panicum*)	168
Joint-grass (*Paspalum*)	21
Barngrass (*Chætochloa*)	271
Wild rice (*Zizania*)	24
Amaranth (*Amaranthus*)	4
Ragweed (*Ambrosia*)	189
Pigweed (*Chenopodium*)	4
Sunflower (*Helianthus*)	13
Gromwell (*Lithospermum*)	1
Plantain (*Plantago*)	1
Weeds—Continued.	Stomachs.
Smartweed (*Polygonum*)	200
Sorrel (*Rumex*)	64
Chickweed (*Alsine*)	9
Unidentified	168
Fruits:	
Blackberry (*Rubus*)	7
Blueberry (*Vaccinium*)	2
Gooseberry (*Ribes*)	1
Strawberry (*Fragaria*)	1
Indian currant (*Symphoricarpos*)	1
Hackberry (*Celtis occidentalis*)	1
Unidentified	14
Miscellaneous:	
Bayberry (*Myrica cerifera*)	2
Beechnuts (*Fagus*)	1
Pine seed (*Pinus*)	10
Sedge (*Carex*)	1
Bulb or tuber	4
Rubbish	54

In the list the chief interest, of course, centers about the grain. Of the four kinds eaten, oats are evidently the favorite, for they were found in 190 stomachs and amount to 6.3 percent of the year's food. April shows a little less than 6 percent for the month, undoubtedly collected from newly sown fields. In June they fall to less than 2 percent, in July rise to 22.6, increase somewhat in August, fall to 4.2 in September, and disappear entirely before the end of October. A few were found in December, but they do not appear in the other winter months. The oats eaten in July were probably taken from standing or newly cut grain, as perhaps were some of those eaten in August; but most of the oats in the United States are cut before the end of July, so that the greater part of those that were taken after this month must have been gleaned from the stubble or pilfered from the shock. Wheat first appears in March to the amount of 1.5 percent, but does not become an important item of food until July, when it rises abruptly to 13.1 percent. As July is the harvest month for wheat in most parts of this country it is reasonably certain that this grain is taken from the standing crop or gathered from the field after the reaper has done its work. August and September show 6.2 and 1.6 percent, respectively, all of which must have been scattered grain except where it could be stolen from the shock. The total amount of wheat for the year is only 2.2 percent. Corn is eaten to the extent of 2.6 percent in February, but the amount increases to 9.2 percent in March, after which it decreases to 3.0 percent in June. It rises through July and August to 7.5 percent in September, but falls off rapidly after September and is unimportant during the remainder of the year. The average for the year is 4.6 percent.

Grain collectively amounts to 13.9 percent of the food of the year, and its distribution as shown above leads to the conclusion that at least half of it is waste. Oats alone show an increased consumption in May, the month of sowing. July and August are the months of maximum consumption. All that is eaten after August, except corn, must be gathered from the stubble, unless the grain is left shocked in the field; and even in that case it is difficult to understand how the birds can do any serious damage if the shocks are properly put up and are not allowed to remain out an unreasonable time.

In order to gain a more thorough understanding of the grain-eating propensities of the redwings, a special study was made of the food for the five months from May to September, inclusive. Forty-six percent of the stomachs taken in May contained grain, and only 11 percent of those taken in June. The ratio then rises in July, and culminates at 72 percent in August, after which it decreases rapidly. The average for the five months is 46 percent; that is, in every 100 birds taken 46 had eaten grain. The grain-eating record, as exhibited by the bulk of the grain food, is quite different. Grain constitutes about 20 percent of the food by bulk in May and less than 6 percent in June, but rises to a maximum of nearly 43 percent in July and falls off slightly in August, after which it rapidly decreases and disappears. The average consumption for the five months is 24 percent of the whole food. Again, if the two months of July and August are considered alone, it will be found that although 68 of every 100 birds have eaten grain, this item constitutes only 41 percent of the food for the two months.

Still further restricting the study to birds taken in the Mississippi Valley, in the same five months, May to September, the percentage of grain shows an important increase. During these months 173 birds were collected in the States of Indiana, Illinois, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa, Nebraska, and Kansas. The number, though small, is sufficient to serve at least as a clue to the food during this period. Grain was eaten by 60 percent of the birds collected in May, by 46 percent of those taken in June, by 80 percent of those taken in July, by 81 percent of those taken in August, and by 45 percent of those taken in September. Of the food of those taken in May, 27 percent was grain of various kinds; in June, 23 percent; in July, 51 percent; in August, 45 percent, and in September, 24 percent; an average of 34 percent of grain for the five months. As these are the ones in which nearly all of the grain is eaten, and as more than half of it is eaten in July and August, the above exhibit apparently shows the worst that the redwings do. Of the 1,083 stomachs examined, only 19 were filled with grain alone, while 217 were entirely filled with the seeds of weeds or useless plants. The total grain consumed, as given above, is less than that

eaten by the crow blackbird (45 percent), the jay (19 percent), or the cowbird (17 percent). In view of the fact that the redwing has been under the ban in many States and in some still remains so, this result is rather surprising. It renders more impressive the fact that the damage is due to overwhelming numbers in that part of the country from which the complaints have come, and not the amount of grain eaten by the individual bird. The unequaled facilities for breeding afforded by that region have in many instances given rise to such immense flocks in a restricted area that, while each bird eats but a trifle, the total is tremendous.

Weed seed is apparently the favorite food of the redwings, since the total amount of grass and weeds is 54.6 percent, more than half of the year's food, and more than four times the total grain consumption. These seeds are the principal article of diet of the birds in the Northern States in the early spring and late fall, and the stomachs received from the South during the winter are filled with them almost exclusively. They amount to more than 3 percent in June, the month of minimum consumption, and constitute a very appreciable percentage even during the months when grain is most abundant. The great bulk consists of the four well-known genera of noxious weeds, *Chætochloa* (barn-grass or foxtail), *Ambrosia* (ragweed), *Panicum* (panic-grass), and *Polygonum* (smartweed and knotweed). The others were found in from 1 to 64 stomachs each, and while not all are as much of a nuisance to clean cultivation as the four named, none have any useful function in agriculture. Fruit forms so insignificant a proportion of the redwing's food that it is hardly worth considering. Blackberries or raspberries were identified by their seeds in 7 stomachs, but only a few were found in each, and the percentage is trifling. The other species taken also appear in few stomachs and in small quantities.

The miscellaneous list contains a collection of makeshifts upon which the bird falls in case of necessity, the most curious of which, perhaps, is the seed of the pine tree. The birds from whose stomachs these were obtained were shot in the very act of picking the seeds from the cones in the top of the tree, a strange employment for an inhabitant of a marsh, but Dr. Coues notes the breeding of this bird near pine trees at a distance from any marsh.[1]

SUMMARY.

In summing up the economic status of the redwing the principal point to attract attention is the small percentage of grain in the year's food, seemingly so much at variance with the complaints of the bird's destructive habits. Judged by the contents of its stomach alone, the redwing is most decidedly a useful bird. The service rendered by the destruction of noxious insects and weed seeds far outweighs the

[1] Birds of the Northwest, p. 187, 1874.

damage due to its consumption of grain. The destruction that it sometimes causes must be attributed entirely to its too great abundance in some localities.

The following table shows the various elements of its food for each month:

Food of the red-winged blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 11; February, 48; March, 84; April, 104; May, 75; June, 158; July, 141; August, 151; September, 56; October, 91; November, 82; December, 82; total, 1,083.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.	Per-cent.
Predaceous beetl's	.....	0.2	3.1	2.7	6.5	6.5	6.5	1.9	1.5	0.3	0.1	0.4	2.5
Snout-beetles	.....	1.3	0.8	6.4	7.2	22.4	7.8	2.5	0.2	0.4	[1]Tr.	0.7	4.1
Other beetles	0.1	2.2	1.2	7.8	11.2	13.4	3.9	1.8	0.1	0.8	[1]Tr.	0.2	3.5
Caterpillars	0.1	2.1	8.2	8.2	20.1	16.4	4.3	0.9	9.5	0.3	[1]Tr.	0.3	5.9
Grasshoppers	.....	0.2	0.2	4.6	3.3	12.7	13.4	17.0	4.1	1.1	[1]Tr.	[1]Tr.	4.7
Other insects	1.2	0.2	0.7	6.0	16.3	9.0	9.8	2.4	1.0	1.6	0.1	0.6	4.1
Spiders and myriapods	.....	0.3	0.5	3.2	2.0	5.8	2.0	0.4	[1]Tr.	0.2	0.1	1.4	1.3
Other animal food	.....	.....	0.7	1.5	1.4	2.0	0.2	0.1	0.1	.....	.....	.....	0.5
Total animal food	1.4	6.5	15.4	40.4	68.0	88.2	47.9	27.0	16.5	4.7	0.3	3.6	26.6
VEGETABLE.													
Fruit	.....	2.0	1.2	0.6	.....	0.5	2.1	0.6	.....	.....	[1]Tr.	.....	0.6
Corn	.....	2.6	9.2	7.8	5.1	3.0	4.2	5.7	7.5	6.9	1.4	1.3	4.6
Oats	.....	.....	.....	5.9	13.5	1.4	22.6	27.3	4.2	0.3	.....	0.2	6.3
Wheat	.....	.....	1.5	2.6	0.7	0.9	13.1	6.2	1.6	.....	0.1	.....	2.2
Other grain	.....	0.8	1.2	2.3	0.4	0.4	2.7	1.8	.....	.....	.....	.....	0.8
Weed seeds	98.6	85.3	70.3	35.7	10.2	3.6	4.5	15.5	55.7	88.0	97.0	91.2	54.6
Other vegetable food	.....	2.8	1.2	4.7	2.2	1.9	2.9	15.9	14.5	0.1	1.2	3.7	4.3
Total vegetable food	98.6	93.5	84.6	59.6	32.1	11.7	52.1	73.0	83.5	95.3	99.7	96.4	73.4

[1] Tr. = trace.

CALIFORNIA RED-WINGED BLACKBIRD.

(*Agelaius gubernator californicus.*)

The California red-winged blackbird is confined to the Pacific coast region west of the Cascades and the Sierra Nevada, and ranges from Washington to Lower California. The stomachs upon which this investigation is based, 61 in all, were collected in California at different times of the year, but none in February, May, or August (see p. 74). Although this number is entirely too small to give data that can be considered final, it is thought best to publish those obtained, as they will give some insight into the character of the food.

Of the total food, only 1.6 percent is animal matter, and the remainder, 98.4 percent, is mostly grain. The animal food consists of beetles, ants, grasshoppers, bugs, caterpillars, and a few spiders—mostly harmful, but so few in number that they are economically insignificant. Of the 98.4 percent of vegetable food, 85.5 percent consists of grain. This is made up of wheat, 28.9 percent; oats, 52.3 percent; and barley, 4.3 percent. Corn was not found. It is probable that this record would be somewhat modified by an examination of a larger series of stomachs representing every month of the year, but it must be remembered that one of the missing months is February, a month when birds feed to a great extent upon vegetable food, and another is August, which is a harvest month. The other vegetable food (12.9 percent) consists mostly of the seeds of noxious weeds.

Further field observation of the habits of this species is needed, but it is probable that the bird does great damage in places where it is abundant, especially in grain-growing sections. In view of the very large percentage of grain in the stomachs, and the fact that grain forms more than half the food in every month, it does not seem probable that the bird is able to supply its wants from the waste grain of the fields and corrals. Even if 50 percent were so obtained, a large percentage, more than 40 percent, of the total food still remains to the discredit of the species. Further investigation is necessary before final conclusions can be drawn, but it hardly seems probable that it can show the California redwing in any other light than that of a source of danger to grain.

THE RUSTY BLACKBIRD.

(*Scolecophagus carolinus.*)

One of the most familiar sights to the New England schoolboy, and one which assures him that spring is really at hand, is a tree full of blackbirds, all facing the same way and each one singing at the top of its voice. These are rusty blackbirds, or rusty grackles, which, on their spring journey to the north, have a way of beguiling the tedium of their long flight by stopping and giving free concerts. Every farmhouse by the wayside will have its visitors, and every boy who hears them is eager to tell his mates that he has seen the first flock of blackbirds. They breed in the Maritime Provinces of Canada, the northern parts of New England, New York, and Minnesota and northwestward nearly to the mouth of the Mackenzie River and Kotzebue Sound, Alaska; and spend the winter in the Southern States as far west as Texas and as far north as southern Illinois. In their migrations they are seen in immense numbers, especially in the Mississippi Valley.

The great majority of these birds nest so far north that they are beyond the limits of cultivation, and consequently have no economic interest during the breeding months. But as soon as the season of reproduction is over they begin to assemble and move southward, and it is evident that such vast flocks as they form might prove a serious menace to any crop on which they chose to prey. Reports, however, have not implicated them to any great degree in the devastation of grainfields, and it seems to be their habit to feed about swamps and in roads and stock yards. That they have a decided taste for foraging in wet ground or about water is shown by the contents of their stomachs, which included aquatic beetles of many species, with larvæ of ephemeridæ, caddice-fly cases, a few dragon-flies, small snails and other mollusks, salamanders, and small fishes.

The food of rusty blackbirds does not seem to have received much attention, but a few ornithologists have given it brief consideration.

Mr. C. J. Maynard reports that he has never found anything in their stomachs except insects and small mollusks.[1]

Col. N. S. Goss says:

> They are largely omnivorous in their food habits, preferring the various forms of insect life, snails, etc., that abound in the aquatic grasses; but during the winter months, when forced to feed largely upon grains and seeds, they frequent the cattle yards and corn fields, and further south forage off the rice plantations.[2]

Dr. Warren says:

> The food of this species consists largely of beetles, grasshoppers, snails and earthworms. They feed to a considerable extent on the seeds of various plants; different kinds of small berries are added to their *menu;* the scattered grains of wheat, rye or other cereals, which are to be found in the fields and meadows, are likewise eaten. When in cornfields they sometimes perch on the shocks and pick from the ears a few grains, the damage, however, which they do in this way is of but little importance.[3]

The investigation of the food of the rusty blackbird made by the Biological Survey is based on 132 stomachs, obtained from 16 States, the District of Columbia, and Canada (see p. 74). These stomachs represent every month of the year except June and July, when the birds are on their breeding range away from well-settled portions of the country. It is to be regretted that none of the months except March, April, October, and November are fairly represented. Few stomachs were obtained in the other months, January having but one to its credit.

The stomachs contained a larger proportion of animal matter (53 percent) than those of any other species of American blackbirds except the bobolink. This is the more remarkable in view of the fact that none were taken in the two breeding months of June and July, when in all probability the food consists almost exclusively of animal matter.

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[1] Birds Eastern N. A., p. 147, 1881.

[2] Hist. Birds of Kansas, p. 408, 1891.

[3] Birds of Pa., revised ed., p. 219, 1890.

While the birds are decidedly terrestrial in their feeding habits, they do not eat many predaceous ground-beetles (Carabidæ), the total consumption of these insects amounting to only 1.7 percent of the whole food. Scarabæids, the May-beetle family, form 2 percent, and in April 11.7 percent. Various other families of beetles aggregate 10.1 percent, largely aquatic beetles and their larvæ, which, so far as known, do not have any great economic importance. A few of the destructive snout-beetles (Rhynchophora) are also included, as well as some chrysomelids and others.

Caterpillars constitute 2.5 percent and do not form any very striking percentage at any time, except, perhaps, in May, when they amount to 11.7 percent. Grasshoppers nearly equal beetles in the extent to which they are eaten, and exceed every other order of insects, although none appeared in the stomachs taken in January, March, May, and December, and in February but a trace. In August, as usual, they reach the maximum, 44.3 percent, only a trifle higher, however, than the October record. The average for the year is 12 percent. Various orders of insects, such as ants, a few bugs, and also a few flies, with such aquatic species as dragon-flies, caddice-flies, and ephemerids were eaten in all the months except January, in which only one stomach was taken. They aggregate 13.7 percent of the whole food, but owing to the number of forms no one amounts to a noteworthy percentage, and many of them are of little economic importance. Spiders and myriapods (thousand-legs) are eaten to the extent of 4 percent and amount to 23 percent in August. Other small animals, such as crustaceans, snails, salamanders, and small fish, were found in the stomachs for nearly every month, and amount to 7 percent of the food of the year, but none of them are important from an economic point of view.

The vegetable food consists of grain, weed seed, and various miscellaneous substances, none of which amounts to any great percentage. The latter consist chiefly of a very small amount of fruit, a little mast, and a number of unidentifiable substances, probably picked up about water or in swamps. Of grain, corn is the favorite and amounts to 17.6 percent of the year's food. It constitutes 87 percent of the contents of the single stomach taken in January, but this record can not be used as a criterion, for with this exception the maximum percentage is 26.5 (average of 15 stomachs taken in November), while the stomachs collected in May, August, and September show not a trace of corn. The fact that corn constitutes respectively only 5 and 4 percent of the contents of the stomachs taken in December and February is additional evidence that the January percentage is exceptional. Wheat and oats collectively amount to only 6.8 percent of the year's food. Oats are apparently preferred and in March constitute 15.4 percent of the month's food. These March stomachs came from the Southern States, so it is probable that the grain was picked up on newly sown fields. Neither wheat nor oats were found in the stomachs taken in August. Grain collectively amounts to 24.4 percent of the

whole food, but from its distribution through the year does not appear to have been taken from the harvest fields. It is probable that some of it was gathered from newly sown fields, but the greater part was undoubtedly stolen from corncribs or picked up in roads and stock yards as waste grain.

Weed seed is not so important an item of food with the rusty blackbirds as it is with the redwings, since with the former it amounts to only 6 percent of the year's food, and contrary to observations on most seed-eating birds, the greater portion of it is apparently eaten in the insect season. Only 1 percent was found in the stomach taken in January, but the amount increases irregularly up to a maximum of 23.3 percent in May. Of June and July we know nothing, but in August, the month in which the redwing begins to increase its seed diet, there is not a single trace of weed seed in the food of the rusty blackbirds. It constitutes 6.6 percent in September, a trifle in October, and 15 percent in November and is entirely absent in the 3 stomachs taken in December. This erratic distribution evidently indicates that weed seed is not sought after, but is simply taken when nothing better is at hand. Miscellaneous items of vegetable food amount to 16.6 percent of the food of the year. Fruit was found in a few stomachs, but does not appear to any important extent. Only three kinds were determined, but several stomachs contained pulp or skin that could not be identified. Several buffalo berries (*Shepherdia argentea*) were found in one stomach, hackberries (*Celtis occidentalis*) in another, and seeds of blackberries or raspberries (*Rubus*) in two or three others. Mast was found in a few stomachs, but the greater part of the miscellaneous food was indeterminable. The birds are evidently great scavengers, and so gather much food that is scarcely susceptible of classification.

SUMMARY.

While this record of the food of the rusty blackbird is somewhat fragmentary it still gives a very good idea of the bird's general diet. One important conclusion that can be drawn is that animal food is preferred, vegetable food serving as a makeshift. It is nearly certain that in June and July, when the birds are engaged in the exhausting function of reproduction, the diet must be almost exclusively animal. If those months were represented in this investigation, the relative proportion of the two classes of food would be much changed, and animal food would take a higher rank. The vegetable food is of little consequence, as the birds show no decided predilection for any particular kind, but eat whatever is at hand when animal food can not be obtained. Grain is not eaten to any great extent at harvest time, and the other items do not seem to have any special relation to the season in which they are eaten. While considerable animal food beside insects is eaten, on the other hand a considerable quantity of harmful

insects is destroyed and very few useful ones are taken. As rusty blackbirds do not inhabit farms, their economic relations can not be said to be very important; but while not preying directly upon noxious insects or weeds which interfere with the cultivation of crops, it is yet possible that they incidentally do considerable good by eating insects. Although their foraging is done mostly in pastures and swamps, yet the insects which they devour count just so much from the sum total, and in the long run the destruction of noxious species is, perhaps, nearly as great a good to the farmer as though they were taken directly from his cultivated fields.

Grasshoppers and many scarabæid beetles are nuisances, and their destruction is a benefit to agriculture, no matter where they may be found. The same may be said of caterpillars and many other insects, which, though now feeding on useless plants of the marsh or thicket, are liable at any time, through an unusual increase in numbers or a change in environment, to turn their attention to some crop and become a veritable pest. On the other hand, aquatic beetles and small crustaceans, which form a considerable percentage of the diet of the rusty grackles, are to a great extent carnivorous in their habits, and it is difficult to see in what way they can ever become of any great economic importance.

The following table shows the percentages of the principal elements of the food for each month:

Food of the rusty blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 1; February, 6; March, 17; April, 49; May, 7; June, none collected; July, none collected; August, 4; September, 5; October, 25; November, 15; December, 3; total, 132.]

Food.	January.	February.	March.	April.	May.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetles	.....	.....	4.5	6.1	.....	1.8	1.6	2.2	0.3	.....	1.7
May-beetle family	.....	2.5	.....	11.7	.....	0.7	.....	3.2	2.2	.....	2.0
Other beetles	.....	37.3	13.4	13.7	25.9	1.0	7.0	1.6	1.3	.....	10.1
Caterpillars	.....	4.0	1.5	5.0	11.7	.....	.....	2.3	0.4	.....	2.5
Grasshoppers	.....	0.2	.....	9.3	.....	44.3	18.6	44.2	3.9	.....	12.0
Other insects	.....	25.8	13.9	15.5	20.0	26.0	16,0	4.5	13.2	1.7	13.7
Spiders and myriapods	.....	0.9	3.8	4.9	4.1	23.0	.....	2.7	0.3	.....	4.0
Other animal food	.....	1.5	7.7	2.5	1.3	.....	16.2	5.1	5.9	30.0	7.0
Total animal food	.....	72.2	44.8	68.7	63.0	96.8	59.4	65.8	27.5	31.7	53.0
VEGETABLE.											
Corn	87.0	4.0	23.8	20.8	.....	.....	.....	9.0	26.5	5.0	17.6
Other grain	12.0	.....	15.4	3.7	12.1	.....	13.4	7.3	4.5	.....	6.8
Weed seed	1.0	0.3	8.4	4.4	23.3	.....	6.6	0.8	15.0	.....	6.0
Other vegetable food	.....	23.5	7.6	2.4	1.6	3.2	20.6	17.1	26.5	63.3	16.6
Total vegetable food	100.0	27.8	55.2	31.3	37.0	3.2	40.6	34.2	72.5	68.3	47.0

BREWER'S BLACKBIRD.

(*Scolecophagus cyanocephalus.*)

Brewer's blackbird breeds from Manitoba and the eastern edge of the Great Plains south to northern New Mexico and westward to the Pacific, and spends the winter in the southern part of this region and in Mexico. The economic status of the species has as yet hardly become well defined, but some complaints have been received from the grain-growing sections, and it may possibly be a pest where it exists in any great numbers. The bird is eminently gregarious most of the year, though less so at breeding time. Like the cowbird, it is an industrious gleaner in pastures, barnyards, and roads, and even invades the streets of towns for the purpose of gathering scattered grain and other forage.

But little testimony is available as to the food of Brewer's blackbird, but Goss says that the members of this species are "social, gregarious birds, breeding in small colonies, and foraging together over the cultivated fields, pastures and plains; indiscriminate eaters of insect life, seeds, etc., and * * * regular visitants of the slaughterhouses."[1] In the investigation by the Biological Survey 146 stomachs were examined, collected from six States and representing every month except April (see p. 75).[2] The first analysis of the food shows that animal matter forms 31.8 percent and vegetable matter 68.2 percent. The animal food consists almost wholly of insects, the only exceptions being a few spiders and snails. The insects are mostly beetles, ants, wasps, and grasshoppers, with a few caterpillars, flies, and bugs. Beetles amount to 7.8 percent of the food of the year. The only group which appears at all prominently is that of the snout-beetles, or Rhynchophora, which in May constitute 29 percent of the food. In the other months they are not found so often, and the average for the year is only 3.4 percent. Predaceous beetles (Carabidæ) are eaten to the amount of 1.7 percent, and are not conspicuous in any month. Hymenoptera constitute 14.8 percent of the food for August, but do not appear very prominently in the other months, and average but 2.5 percent for the year. They consist for the most part of wasps and ants, with a few of the smaller parasitic species.

Grasshoppers are the favorite insect diet, constituting more than half of the total animal food (16.1 percent). Only a trace appears in the February stomachs, but in March the amount increases to 20.5 percent, and except in July does not fall below this figure until October. In August, which as usual is the month of greatest consumption, grasshoppers constitute 47.5 percent—nearly half of all the food.

[1] Hist. Birds of Kansas, p. 409, 1891.

[2] One stomach was taken in April, but as its contents were quite unlike the average of those collected in March and May, it has been discarded until more can be obtained for the same month.

In July the percentage falls to 8.2, apparently because at that time the grain harvest is at hand and the birds eat freely of oats, wheat, etc. The miscellaneous list is made up of a few flies, bugs, and caterpillars, the latter such as might be expected in the stomach of a bird of the habits of the species under consideration, though the number really found is surprisingly small. One stomach taken in California in March contained 90 per cent of caterpillars, and a few other stomachs contained them in smaller amounts; but they do not constitute an important percentage of any month. Mr. J. F. Illingsworth, of Ontario, Cal., says that he has never failed to find from one to five worms [caterpillers] in each stomach that he has examined, which indicates that under some circumstances they do eat these insects extensively.

The vegetable food of Brewer's blackbird is preeminently grain, which amounts to 60.3 percent of the total food of the year, while all other vegetable food aggregates only 7.9 percent. Oats, corn, wheat, and a little barley are eaten, and of these oats are the most important, amounting to nearly three-fourths of the total quantity and being eaten in every month of the year.[1] Corn stands next to oats, but far below in quantity; wheat follows next in order, and barley comes last, the latter having been found in only two stomachs.

So important an element is grain that it constitutes more than 50 percent of the food in each of eight months, and in May, the month of least consumption, still amounts to 21 percent of the whole food. While much of this may be waste grain, it can hardly be probable that all of it is picked up in highways and byways. In July it amounts to nearly 72 percent of the food, and there can be no doubt that much of this is gathered from ripening fields. Other vegetable food consists for the most part of weed seed, but the small amount differs remarkably from the quantities eaten by the redwing and cowbird, which are great weed destroyers at all times, and especially in winter. Brewer's blackbird eats grain in every month, and in winter subsists upon it almost entirely. Mr. Walter K. Fisher, writing from Stockton, Cal., reports it as feeding on newly sown wheat that had not been harrowed in and eating nearly all that had been thus left exposed. He describes the birds as visiting the fields in immense flocks, which, at a distance, look like smoke rising from the ground, and says that stomachs of birds taken on such fields were found to be full of wheat.

SUMMARY.

In summing up the results of this investigation it must be acknowledged that the stomachs examined are too few, and are not distributed widely enough geographically, to justify a final economic classification of the bird. Nevertheless some very salient points seem to have been

[1] The greatest quantities were found in stomachs taken in January at Escondido, Cal.

brought out, viz: (1) No order of insects is especially sought except grasshoppers (Orthoptera), which constitute more than half of the animal food; (2) more than 88 percent of the vegetable food consists of grain, which is eaten freely at all seasons, even when insects are abundant; and (3) seeds of harmful weeds are eaten sparingly.

In spite of this apparently discreditable record complaints of this blackbird have been fewer than of several other species, while, on the other hand, some observers speak highly of it. Prof. A. J. Cook, of Claremont, Cal., says that he considers it one of the most valuable species in that State. So far as shown by field observation and stomach examination it does not attack fruit, and this is an important point in a California bird. Mr. J. F. Illingsworth, of Ontario, Cal., in a paper read before the Pomona Farmers' Club,[1] speaks of the species as a beneficial one that should be protected. It is possible that the large amount of grain found in the stomachs consists principally of gleanings from the harvested fields, corrals, and other places; but even if this be true, a bird with such a pronounced taste for grain would, if abundant, always be a menace to ripening crops. The following tabular statement shows the principal elements of the food:

Food of Brewer's blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 7; February, 7; March, 4; April, no stomachs collected, May, 7; June, 10; July, 10; August, 24; September, 38; October, 14; November, 10; December, 15. Total, 146.]

Food.	January.	February.	March.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Predaceous beetles	5.0	0.6	.....	0.3	3.3	.....	3.9	0.9	.....	3.7	1.1	1.7
Snout-beetles	.....	0.4	2.0	29.0	4.5	0.5	[1]Tr.	0.3	.....	0.2	0.9	3.4
Other beetles	3.4	3.0	0.3	3.0	13.7	3.8	0.6	0.3	0.4	0.9	0.3	2.7
Wasps, ants, etc	.....	0.1	0.5	0.8	3.2	0.4	14.8	0.6	7.2	.....	0.1	2.5
Grasshoppers	.....	0.2	20.5	33.3	26.8	8.2	47.5	33.1	0.6	.....	7.1	16.1
Other insects	1.0	4.0	22.5	9.0	10.6	.....	0.6	1.1	0.8	8.4	0.9	5.4
Total animal food	9.4	8.3	45.8	75.4	62.1	12.9	67.4	36.3	9.0	13.2	10.4	31.8
VEGETABLE.												
Grain	90.6	77.1	53.2	21.0	32.7	71.9	29.8	48.1	85.4	71.8	81.7	60.3
Other vegetable food	.....	14.6	1.0	3.6	5.2	15.2	2.8	15.6	5.6	15.0	7.9	7.9
Total vegetable food	90.6	91.7	54.2	24.6	37.9	87.1	32.6	63.7	91.0	86.8	89.6	68.2

[1]Tr. = trace.

[1] Ontario Observer, June 3, 1899.

THE CROW BLACKBIRD.[1]

(*Quiscalus quiscula.*)

Throughout the Eastern States and Mississippi Valley the grackle, or crow blackbird, is one of the most familiar and conspicuous birds. It appears in spring and early summer about farmhouses and villages, where it finds its favorite nesting places. Five different kinds occur within our borders, but the present paper is concerned only with the common purple grackle (*Quiscalus quiscula*) and its two subspecies, the bronzed grackle (*Quiscalus q. æneus*) and the Florida grackle (*Quiscalus q. aglæus*). The purple grackle is abundant in the region east of the Alleghenies as far north as New York, and is found sparingly in New

FIG. 6.—Crow Blackbird.

England. The Florida grackle is distributed over the region extending from the coast of South Carolina southward into the peninsula of Florida and westward to Louisiana. The bronzed grackle occupies the Mississippi Valley and Great Plains as far west as the Rocky Mountains, ranges northward to Great Slave Lake and southern Newfoundland, and east to the coast of southern New England.

In Canada and the Northern United States the crow blackbird is only a summer resident, but in the Southern States it is present throughout the year, and in winter its numbers are increased by millions of migrants from the North, which find here a congenial winter

[1] Revised and republished from the Yearbook of the Department of Agriculture for 1894, pp. 233–248, with the addition of new material.

home. It does not occur south of the Gulf States, but stragglers have been found during the cold months as far north as Illinois and even Minnesota.

At the first approach of spring the crow blackbirds begin to move northward, closely following the retreat of winter. During the summer months they cover the whole of the United States east of the Rocky Mountains, except New England, though they are most plentifully distributed over the great grain-raising States of the Northwest. In New England crow blackbirds are of local occurrence. They are tolerably abundant in Connecticut, but in the more northern States breed only in certain favored localities, and are entirely absent from large areas.

In the Northern United States the southward movement begins about the end of September, although the habit of collecting in flocks immediately after the breeding season causes the birds to disappear from many localities during the month of August. Their stay in the northern part of the country is thus limited to the six warmest months of the year; hence whatever they do that is either beneficial or injurious must be accomplished during that time. In the South, on the contrary, they are found throughout the year, and in largely increased numbers during the winter. Fortunately, however, the time of their greatest abundance is not the season of growing crops, so that the damage done is principally confined to the pilfering of grain left standing in the shock. It is probable, however, that at this season they feed largely on weed seeds, mast, and waste grain scattered in the field.

Crow blackbirds are gregarious, usually breeding in colonies and migrating in flocks. In fall, young and old collect in large assemblages, which in the Mississippi Valley often grow to enormous size. The redwing (*Agelaius phœniceus*), Brewer's blackbird (*Scolecophagus cyanocephalus*), and the rusty blackbird (*S. carolinus*) often associate with them. Moving southward, immense flocks cross the Red River Valley between Texas and Indian Territory. In September, 1886, Mr. George H. Ragsdale reported at Gainesville, on the Texas side of the river, "flocks of such size that the roar of their wings could be heard for a quarter of a mile," and that, according to a statement published in a local paper, one person had on hand 8,000 blackbirds which had been netted for the use of gun clubs. Mr. Ragsdale stated that at the same time the grass worm was destroying the crab-grass and purslane, and attributed the unusually large flocks of blackbirds to the fact that the early fall migrants, finding so many worms, had halted until the bulk of the birds drifted southward. About the first of October the worms and birds disappeared simultaneously.

Crow blackbirds are well known to the farmer as foragers about the barnyard and pigpen. When they arrive in spring, after their long journey from the South, they are apt to depend on the corncrib for

some of their first meals; but when the plow begins its work they are on the alert, and follow it up and down the furrows, seizing every grub or other insect that may be turned up. Their industry in this respect is very noticeable, and if not disturbed or frightened in any way they often become so tame as scarcely to get out of the way of the team in their eager search for food. Very soon a nest is built, and in a short time four or more gaping mouths demand to be filled, and the parent birds must then work harder and go farther afield to provide for the increased number of stomachs. When the cherries and other early fruits ripen, the birds take a share for themselves thinking, no doubt, that they are fairly entitled to them for the good work they did earlier in the season. When the corn 'comes into the milk' they also take a portion.

In the selection of food the crow blackbird is almost omnivorous. Its partiality for corn, wheat, rice, oats, and other grain is well known, and is the cause of nearly all the complaints about its depredations. This diet is supplemented by various fruits, berries, nuts, seeds, and insects, the last in large proportion. But the character of the food varies materially with the season. During the fall and winter blackbirds subsist largely on seeds and grain, as spring approaches they become more insectivorous, in summer they take small fruits, and in September they attack the ripening corn; but at all seasons they probably select the food that is most easily obtained.

To this varied diet are due the conflicting statements respecting the useful or noxious habits of the species. When feeding on grain, the birds are usually in large flocks and their depredations are plainly visible. When breeding they are less gregarious, and the good work they do in the fields is scarcely noticed, although at this season the grubs and other insects devoured compensate in large measure for the grain taken at other times. As Mr. N. W. Wright, of Farmland, Ind., aptly says, "It is hard to tell on which side to place the crow blackbirds, for we can see the damage done, but not the benefits."

During the spring they destroy many noxious insects. Prof. D. E. Lantz states that at Manhattan, Kans., from the time of their arrival until August they feed almost entirely upon cutworms, and Prof. Herbert Osborne, writing from Ames, Iowa, reports that during the spring of 1883 he saw them destroy great numbers of May-beetles (*Lachnosterna fusca*), and found them feeding on them for several weeks. Grasshoppers, crickets, locusts, and other insects are also largely eaten. Mr. J. Percy Moore, of Philadelphia, Pa., wrote in 1885:

> During the recent visit of the 17-year cicada this species [the purple grackle] devoured immense numbers of pupæ and imagos. It also ate large numbers of the grubs of the June bug, which it generally obtained by searching in the furrows in newly plowed fields, and all stages of the Carolina and other grasshoppers, the common white butterfly (I saw one catch several of this species on the wing May 26, 1885), and other species not identified.

Mr. W. B. Hall, of Wakeham, Ohio, gives an interesting account of some young grackles which were kept in captivity. He says:

> I have captured the young and confined them in a cage in such manner that the old bird could not reach the mouth of the young. The food brought consisted largely of larvæ of *Coleopterous* and *Lepidopterous* insects, with an occasional beetle. If freshly plowed fields were in the vicinity the food consisted largely of the white grub and cutworm, a few tent caterpillars, one worm that I took to be a small *Attacus*, and beetles of the genera *Galerita*, *Cetonia*, *Lachnosterna*, and their kindred.

An estimate of the amount of food required to support a large flock of blackbirds has been made by Mr. H. H. Johnstin, of London, Ohio. During the autumn of 1894 he counted 1,100 blackbirds one morning as they left their roosting places for the feeding grounds, and estimated the birds which flew by at 50,000. Allowing 2 ounces as the quantity of food collected by each bird during the day, he arrived at the conclusion that 6,250 pounds, or more than 3 tons, of food was consumed by this army of blackbirds in a single day. Even if the number of birds in this case is not overestimated, the amount of food per bird is undoubtedly too great. The species of blackbirds to which these notes refer are not stated, but it is safe to assume that the flocks were made up of redwings (*Agelaius*) and crow blackbirds (*Quiscalus*). A full stomach of the crow blackbird, selected at random from specimens in the collection of the Biological Survey, was found to weigh 0.158 ounce, or 2.53 drams, while the contents of another stomach weighed only 0.116 ounce, or 1.85 drams. The average of two full stomachs of red-winged blackbirds was 0.049 ounce, or 0.78 dram, and the stomach contents of a third weighed only 0.021 ounce, or 0.33 dram. While of course these figures do not give the quantity of food a bird consumes in twenty-four hours, they show that the full stomach of a blackbird weighs comparatively little. In order to consume 1 ounce of food per day a crow blackbird must eat six or eight full meals, according to the kind of food, and the redwing three or four times as many. At this rate the amount consumed by the flock of 50,000 birds would be about a ton and a half per day. These figures are undoubtedly still too large, but they serve to give a slight hint of the quantity of grain a large flock could destroy.

The accusations against the crow blackbird, briefly stated, relate mainly to the destruction of grain, especially corn, soon after planting in the spring, and again in the autumn, when the corn is 'in the milk' and nearly ripe. In the Southern States rice is also destroyed by grackles. In some sections they are said to feed upon young grain in such quantities as seriously to injure the value of the crop, and for this reason they are poisoned in large numbers. A more effectual method is to prevent the birds from taking the seed by tarring the corn before it is planted. This is better, simpler, and cheaper than the wholesale destruction of the birds.

Mr. S. T. Kimball, of Ellington, Conn., says:

> As a rule, farmers here tar their corn, but last June I sowed some without tarring, and the result was that by the time it was out of the ground the blackbirds had attacked it. They worked all day, carrying their bills full—load after load—to a cemetery where there is quite a colony. They kept this up till the corn was entirely absorbed by the stalk, although I shot some five or six of them.

Mr. George K. Cherrie states that in Monona County, Iowa, during the spring of 1884, both the crow blackbird and the yellow-headed blackbird did considerable damage by pulling the corn just as it came through the ground, and were poisoned in great numbers by corn which had been soaked in water containing arsenic. Similar depredations are sometimes committed in the rice fields of the South.

According to Mr. W. C. Percy, jr., of Bayou Goula, La., the crow blackbirds destroy rice and corn at that place to a great extent, and would do so totally were not men stationed with guns. They eat it in planting time only.

In the autumn, when the corn begins to ripen, the fields are again visited by blackbirds in larger flocks than in the spring, and the birds renew their work of destruction. Mr. Daniel S. Wardsworth reports that in a field of 2 acres near Hartford, Conn., the grackle has been known to ruin from one-third to one-half of a crop of corn 'in the milk' or when ripe. A similar complaint was made by Mr. George H. Selover, of Lake City, Minn.

Mr. S. Powers, of Lawtey, Fla., writes that in the section where he lives corn is left on the stalk as long as possible, to escape the weevils, and the blackbirds eat the ends of many ears, sometimes one-third of their length.

Another accusation often made against the crow blackbird is that it destroys the eggs and young of other birds. A cursory examination of the statements of writers shows that very few are based on original observation; the majority are either repeated from the observations of others or are taken from published accounts of the bird's habits. It can not be doubted, from the statements which have been made, that these birds do occasionally destroy the eggs of the robin, bluebird, chipping sparrow, small flycatchers, and other species, and more rarely the young of the robin. But stomach examination offers little corroborative evidence. Of 2,346 stomachs, only 37 contained any trace of birds' eggs, and 1 contained the bones of a young bird. These were distributed as follows: In April, 9; May, 9; June, 7; July, 7; and August, 5. The greatest quantity of eggshell was found in May, aggregating forty-six one-hundredths of one percent of the stomach contents for that month. This certainly does not show that blackbirds are much given to robbing their neighbors. Further, the eggshells found in a number of stomachs were identified as those of domesticated fowls, and were probably obtained from compost heaps,

where they had been thrown. Hence, it seems fair to infer that the grackle indulges its nest-robbing proclivities only occasionally, and that the prevalence of the habit has been considerably exaggerated.

The crow blackbird, by reason of its habits, numbers, and wide distribution over the eastern part of our country, is so conspicuous among the native birds that much valuable information concerning its food habits is contained in previous publications.

Wilson refers to it as a 'noted depredator' that 'is well known to every careful farmer of the Northern and Middle States,' and says:

> About the 20th of March the purple grakles visit Pennsylvania from the south, fly in loose flocks, frequent swamps and meadows, and follow in the furrows after the plough; their food at this season consisting of worms, grubs, and caterpillars, of which they destroy prodigious numbers, as if to recompense the husbandman beforehand for the havoc they intend to make among his crops of Indian corn. * * * The trees where these birds build are often at no great distance from the farm house, and overlook the plantations. From thence they issue, in all directions, and with as much confidence, to make their daily depredations among the surrounding fields, as if the whole were intended for their use alone. Their chief attention, however, is directed to the Indian corn in all its progressive stages. As soon as the infant blade of this grain begins to make its appearance above ground, the grakles hail the welcome signal with screams of peculiar satisfaction, and, without waiting for a formal invitation from the proprietor, descend on the fields and begin to pull up and regale themselves on the seed, scattering the green blades around. * * * About the beginning of August, when the young ears are in their milky state, they are attacked with redoubled eagerness by the grakles and redwings, in formidable and combined bodies. They descend like a blackening, sweeping tempest on the corn, dig off the external covering of twelve or fifteen coats of leaves, as dexterously as if done by the hand of man, and, having laid bare the ear, leave little behind to the farmer but the cobs, and shriveled skins, that contained their favorite fare. I have seen fields of corn of many acres, where more than one-half was thus ruined. Indeed the farmers in the immediate vicinity of the rivers Delaware and Schuylkill, generally allow one-fourth of this crop to the blackbirds, among whom our grakle comes in for his full share.
>
> * * * As some consolation, however, to the industrious cultivator, I can assure him, that were I placed in his situation, I should hesitate whether to consider these birds most as friends or enemies, as they are particularly destructive to almost all the noxious worms, grubs, and caterpillars, that infest his fields, which, were they allowed to multiply unmolested, would soon consume nine-tenths of all the production of his labour, and desolate the country with the miseries of famine.[1]

Nuttall speaks of the bird's destructiveness in the cornfield in much the same terms, and adds:

> Up to the time of harvest, I have uniformly, on dissection, found their food to consist of these larvæ, caterpillars, moths, and beetles, of which they devour such numbers, that but for this providential economy, the whole crop of grain, in many places, would probably be destroyed by the time it began to germinate. In winter they collect the mast of the beech and oak for food, and may be seen assembled in large bodies in the woods for this purpose.[2]

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[1] Am. Ornith., Edinburgh ed., Vol. I, pp. 227–230, 1831.

[2] Manual of Ornith., Land Birds, pp. 195–196, 1832.

Mr. C. J. Maynard repeats the charges of depredations in the cornfield, but contends that their trait of robbing nests of other birds is by far the worst damage they do. He says:

They will visit the homes of those species which build in accessible situations and deliberately remove the eggs or, what is more to be deplored, the helpless young and devour them in spite of the cries of the distracted parents who are powerless to prevent the outrage. * * * So frequently were these depredations committed upon the homes of the Robins and other birds, that built about my place this season, that there was scarcely an hour in the day during early summer when I could not hear the warning cries of the adult birds, followed by the harsh, scolding notes of the Crow Blackbird as he was vigorously attacked on all sides, but he seldom retreated without accomplishing his purpose. Such continuous slaughter must greatly thin the ranks of the birds that are thus robbed and it will be safe to say that the Purple Grackles destroy more birds than all the other predatory species combined. * * *

In Florida * * * they also eat a variety of food. In early Winter large flocks may be seen on the tops of the palmettos, feeding on the fruit, and they also eat berries in their season. Later small flocks are found on the margin of streams, frequently wading into them in search of little mollusks, crabs, etc., and it is not rare to meet with one or two scattering individuals in the thick hummocks, overturning the leaves in order to find insects or small reptiles which they devour. I once saw one catch a lizard which was crawling over the fan-like frond of a palmetto, and fly with it to the ground. The reptile squirmed all the while in its frantic endeavors to escape, but the Blackbird held it firmly and, after beating it to death, removed the skin as adroitly as if accustomed to the operation, then swallowed the body.[1]

Dr. B. H. Warren says as a result of his investigations of the food of the crow blackbird:

In the wake of the plowman, as he turns the crumbling earth, closely follow the argus-eyed Grackles, ever on the alert to seize the wriggling worm, the agile beetle, or the glistening grub, and the numerous *larvæ* thrown out as each furrow is turned. Certainly, at this season our sable acquaintances are engaged only in that which will prove of utility to the cultivator when his crops are growing. We repeatedly hear of how the blackbirds tear up and devour the young and growing corn. This, unquestionably, is sometimes the case, but I am confident that the destruction thus done is much exaggerated. I am aware that on more than one occasion I have seen the tender blades of corn lying on the ground where were actively at work Crow Blackbirds, a number of which were shot, and on a post-mortem dissection their stomachs revealed almost entirely insects. Some six years ago I was visiting a friend who had thirty-odd acres of corn (maize) planted. Quite a number of "blackies," as he styled them, were plying themselves with great activity about the growing cereal. We shot thirty-one of these birds feeding in the corn field. Of this number nineteen showed only *cut-worms* in their stomachs. The number of cut-worms in each, of course, varied, but as many as twenty-two were taken from one stomach. In seven some corn was found, in connection with a very large excess of insects, to wit: Beetles, earth-worms, and cut-worms. The remaining five showed chiefly beetles. * * *

Strawberries, blackberries and other fruits are fed upon, but to a very limited extent, by this species. The diet of the young birds, while under parental care, is almost exclusively insectivorous, consisting mainly of caterpillars and grubs.

It is a well-established fact that they are given to pillaging the eggs of other birds, especially the common Robin. Gentry, however, states that they destroy the young of birds, a fact, as yet, unobserved by the writer.[2]

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[1] Birds of Eastern N. A., pp. 149–150, 1881.

[2] Birds of Pa., revised ed., pp. 221–222, 1890.

Nearly 2,500 crow blackbird stomachs have been examined in the laboratory of the Biological Survey, of which 2,346 contained food; the remainder were empty. These stomachs were obtained from twenty-seven States, the District of Columbia, and Canada (see p. 75). Nebraska and Dakota are the most western States in which any were collected, and Florida and Texas the most southern. The stomachs were taken during every month in the year, but as the great body of the birds leaves the Northern States in October and does not return until March, but few stomachs could be procured in November, December, January, and February. Great pains were taken to secure a large number during the breeding months of May and June, with the result that a little more than half of the whole collection was obtained at this time. Observation has shown that the food of young birds often differs materially from that of the adults, and in order to test this point 456 nestlings were collected in May and June.

The food of the whole year, taking into account all the 2,346 stomachs, young and adult, comprised 30.3 percent animal, and 69.7 percent vegetable matter. The animal food was found to be composed of insects, spiders, myriapods, crayfish, earthworms, sowbugs, hair snakes, snails, fish, tree toads, salamanders (newts), lizards, snakes, birds' eggs, and mice.

Insect food constitutes 27 per cent of the entire food for the year, and is the most interesting part of the bird's diet from an economic point of view.

When it is examined month by month, the smallest quantity appears in February (less than 3 per cent of the whole food), but as only 8 stomachs were taken in this month the result can not be considered very reliable. In March it rises to one-sixth, and steadily increases till May, when it reaches its maximum of five-eighths of the whole; it then decreases to one-sixth in October, and appears to rise again in November, but the number of stomachs taken in that month is too small to warrant any general conclusions. The great number of insects eaten in May and June is due in part to the fact that the young are fed largely on this kind of food.

Analysis of the insect food presents many points of interest. Among the most important families of beetles are the scarabæids, of which the common June bug or May-beetle and the rose bug are familiar examples. These insects are eaten, either as beetles or grubs, in every month except January and November; in May they constitute more than one-fifth, and in June one-seventh of the entire food. The habit grackles have of following the plow to gather grubs is a matter of common observation which has been fully confirmed by stomach examinations. Many stomachs were found literally crammed with grubs, and in many more, where other food predominated, the hard jaws showed that grubs had formed a goodly portion of a previous meal.

The species most commonly found in the stomach belong to the well-known genus *Lachnosterna*, or common May-beetle, several species of dung-beetles belonging to the genera *Aphodius* and *Ataenius*, and the wonderfully brilliant *Phanæus carnifex*. The last is one of the most conspicuously colored of all the beetles, being clad in green, purple, and gold, which shade to crimson with the changing light. Whether these splendid tints attract the birds' attention, whether there is some peculiarly agreeable flavor to recommend the insects as an article of diet, or whether the simple fact of availability from their great abundance impels the birds to eat them so freely is yet to be determined; but, from whatever cause, a majority of the stomachs of all the grackles taken in the Mississippi Valley during summer contained at least a trace and often the remains of several of these beetles.

Curculios, snout-beetles or weevils, are eaten in every month of the year, but, while they are taken in great numbers, the individuals are so small that the percentage of bulk does not rise as high as in the case of the scarabæids. The maximum is reached in June, when they constitute more than 5 percent of the total food, with a gradual decrease in the succeeding months. Insects of such small size could hardly be obtained except by diligent search, and their presence in so many stomachs (1,059), and also the large numbers in single stomachs (sometimes exceeding 40), warrants the conclusion that they are sought as choice articles of food. The species most often eaten are *Epicærus imbricatus*, *Phytonomus punctatus*, *Sitones hispidulus*, and more rarely *Sphenophorus zeæ* and other species of *Sphenophorus*. Of this last, commonly known as the corn weevil, 17 were found in one stomach and 14 in another.

Many other beetles were found in the stomachs, but, with one exception, in quantities too small to be of much economic interest. The Colorado potato beetle was not present, but several species belonging to the same family were identified. The one exception just referred to is that of the carabids or predaceous beetles. These valuable destroyers of noxious insects are eaten in every month of the year in varying quantities, but with less variability than most other insects. They constitute more than 7 percent of the food in January, attain a maximum of 13 percent in June, and end with one-half percent in December. From these figures it would seem that they are highly prized by blackbirds; but there are other facts that have a bearing on the case. Most carabid beetles are of fair size and easily seen, and many of them are quite large; moreover, they live on the ground and are much oftener seen running than flying. They are the first beetles observed in spring, and are usually abundant at all times when insects are to be found. Since blackbirds seek a great portion of their food on the ground it is apparent that these beetles must naturally fall in their way oftener than any others, and so are freely eaten, especially

if other food be wanting. They may thus be eaten more from necessity than from choice. It does not, however, necessarily follow that birds are doing harm by eating insects that on account of their food habits are classed as useful. This point has been fully elucidated by other writers, notably by Prof. S. A. Forbes.[1]

Next in importance to beetles as an article of blackbird diet are the grasshoppers. For convenience, grasshoppers, locusts (green grasshoppers), and crickets are considered in the same category, but of the three the true grasshoppers were by far the most numerous in the stomachs, and are eaten in every month except January. They constitute less than 1 percent of the total February food, and the fact that they are found at all in this month indicates that the birds are keen hunters, for it would puzzle an entomologist to find grasshoppers in February in most of the Northern States. It is probable that some of those eaten in this and the succeeding month are dead insects left over from the previous year. The proportion of grasshoppers in the stomachs increases with each month up to August, when it attains a maximum of 23.4 percent of all the food. It is worthy of note that crickets, considered apart from grasshoppers, reach their maximum in June, when they form a little more than 5 percent of the monthly food.

After August the grasshopper diet falls off, but even in November it still constitutes 9 percent of the total for the month. The frequency with which these insects appear in the stomachs, the great numbers found in single stomachs (often more than 30), and the fact that they are fed largely to the young, all point to the conclusion that they are preferred as an article of food, and are eagerly sought at all times. The good that is done by their destruction can hardly be overestimated, particularly as many of the grasshoppers found in the stomach were females filled with eggs.

Caterpillars form another interesting element of this bird's food. They were found throughout the year, except in November, and average 2.3 percent in each month. In May a maximum of something more than 8 percent is reached, followed by a little less than 4 percent in June, and falling below this through the remainder of the year. The famous army worm (*Leucania unipuncta*) was identified in about half a dozen stomachs.

Most persons who have picked and eaten berries from the bushes have had the disagreeable experience of getting into their mouths a small bug which is a little too highly flavored to suit the taste of the human race, but which is eaten by the crow blackbird in every month from February to October, inclusive. These bugs are not, however, consumed in large quantities, probably for the reason that great numbers can not be found; still, traces of them appear in many stomachs, indicating that the birds eat as many as they find.

[1] Bull. Ill. State Lab. Nat. Hist., Vol. I, No. 3, Nov., 1880.

In addition to the insects specified, representatives of several other orders were found, but not in such large or regular quantities as to render them an important element of food. Hymenoptera are represented mostly by ants, while flies are entirely absent, being probably too lively to be taken by such sluggish birds. Spiders and myriapods (thousand-legs) were noted in sufficient numbers to demand recognition. They are eaten to some extent during every month, but not, as a rule, in large quantities. The spiders attain a maximum of more than 7 percent in May, and not only the spiders themselves, but their cocoons full of eggs appear to be taken whenever found. The myriapods are eaten somewhat less frequently, but appear in nearly every month.

Crustaceans, represented by crayfish, are very commonly eaten, though they do not constitute a large percentage of the food. It often happens that the only trace of these creatures found in a bird's stomach consists of the gastroliths, or 'stomach stones,' which are two saucer-shaped calcareous bodies found one on each side of the crayfish's stomach. One grackle, taken in Iowa, had no less than 26 of these stomach stones in its stomach. It seems hardly probable that this bird had eaten 13 crayfish at one meal or within a very short time, and it is possible that the gastroliths had been picked up on the banks of a pond or stream where the crustaceans had died and left their remains. In addition to crayfish, a few sowbugs (*Oniscus*) were found in some of the stomachs.

Snails of various species, both terrestrial and aquatic, with a few small bivalve mollusks, are also eaten by blackbirds, but, like the crustaceans, they form only a small percentage of the food. It might at first be supposed that these creatures were taken for the sake of the lime in their shells, as an aid in forming the eggshells of the blackbirds, but we find that they are eaten by both adult and young birds, by both sexes and at all seasons, which precludes the idea that the lime is used exclusively for this purpose. Earthworms were found in only a few stomachs, their *setæ* being noticed in a few others; but such soft and probably easily digested creatures are difficult to identify when they have been in the stomach a short time, and so may be easily overlooked.

The vertebrate food of the grackles consists of mice, birds and their eggs, lizards, snakes, frogs and salamanders (newts), and fish. So few remains of mice were found that these mammals can hardly be considered a legitimate article of the birds' diet. Birds and their eggs have been already discussed. Lizards' remains were found in a few stomachs taken in Florida, and the vertebræ of snakes were found occasionally, but not often. Frogs, tree toads, and salamanders are eaten, but not frequently, and do not appear to be a favorite food, or else are not easily taken. The same may be said of the fish whose bones appear now and then in the stomachs.

The vegetable component of the stomach contents is as variable and diversified as the animal food, showing plainly that when one article of diet is wanting the bird can make up the deficiency by eating something else that is more easily obtained. The following list includes all the vegetable substances identified in the stomachs, but there were some that could not be positively determined. The pulp of fruit, when unaccompanied by seeds and already half digested, is difficult to distinguish with precision, and this is also true of the hulls or skins left after kernels of grain have been digested and passed; but the total of such unrecognized matter is not great.

Vegetable substances found in stomachs of crow blackbirds.

Grain:
- Corn.
- Oats.
- Wheat.
- Rye.
- Buckwheat.

Fruit:
- Blackberries and raspberries.
- Strawberries.
- Cherries (cultivated).
- Mulberries.
- Currants.
- Grapes.
- Apples.
- Blueberries and cranberries (*Vaccinium* sp.).
- Huckleberries (*Gaylussacia* sp.).
- Dogwood berries (*Cornus* sp.).
- Elderberries (*Sambucus* sp.).
- Chokeberries (*Aronia arbutifolia*).
- Service berries (*Amelanchier canadensis.*)
- Hackberries (*Celtis occidentalis*).

Seeds and nuts:
- Poison ivy (*Rhus radicans*).
- Harmless sumac (*Rhus glabra et al.*).
- Bayberries (*Myrica cerifera*).
- Hornbeam (*Ostrya virginiana*).
- Chestnuts and chinquapins (*Castanea dentata* and *pumila*).
- Beechnuts (*Fagus atropunicea*).
- Acorns (*Quercus*).

Weeds:
- Ragweed (*Ambrosia*).
- Barngrass (*Chœtocloa*).
- Gromwell (*Lithospermum*).
- Smartweed (*Polygonum*).
- Pokeweed (*Phytolacca*).
- Sorrel (*Rumex*).

Miscellaneous:
- Small bulbs or tubers.
- Galls containing larvæ.
- Pieces of plant stems.
- Bits of grass and leaves.
- Thorn of locust (*Robinia*).
- Pieces of rotton wood.

Of all the various items of food, the chief interest centers about the grain and fruit, for it is through their consumption that blackbirds inflict the greatest damage upon the farmer; in fact, the worst that has been said of the grackles is that they eat large quantities of grain. Of the five grains named in the list corn is the favorite, having been found in 1,321 stomachs, or more than 56 percent of the whole number. It is eaten at all seasons of the year; and in every month except January, July, August, and November amounts to more than one-half of the total vegetable food. The corn obtained in winter and until planting in the spring can be but little loss to the farmer, as it must be mostly waste grain. This view was fully confirmed by the contents of a series of stomachs taken in early spring, which consisted to a great extent of corn that had evidently been wet and frozen, and had lain out all winter. After February there is a

decrease in the quantity of corn eaten until July, when it reaches a minimum of 7.7 percent. May shows no increase over the preceding months, although it is the time for planting; nor is there an important increase in June, the month of sprouting corn in the North. In fact, very little evidence was found to indicate that blackbirds pull up sprouting grain. In this respect they differ conspicuously from the crow. In August corn amounts to one-seventh of the whole food, and this, together with a part of that taken in September, is green corn 'in the milk.' The maximum amount, 82 percent, is eaten in February, but this, as already stated, is chiefly waste. In September and October, on the other hand, when corn constitutes 53.2 and 51.5 percent, respectively, of the food totals, it is undoubtedly all taken from the fields of standing corn, representing so much good grain contributed by the farmer; and in the Middle and Western States, where grain often stands in the fields until December, the November corn food must be obtained in the same way.

Oats, which are eaten in very irregular quantities in every month except January, November, and December, form much less of the food than corn. They appear in the greatest amount in April (a little more than one-seventh of the total food), fall to less than 1 percent in June, but rise to more than 9 percent in August. The oats eaten in April are probably picked up from newly sown fields, and it is likely that those taken in August and September are gleaned from fields after harvest, while those found in the other months are accidental and of no importance.

Wheat is eaten in every month from April to September, inclusive, but makes very little showing except in July and August, when it forms 26 percent of the whole food, these being the only months of the year in which it reaches a higher percentage than corn. As July and August are the months of the wheat harvest, it is easy to account for the large amount eaten at that time; but whether the grain so eaten is taken from the standing crop, or consists merely of scattered kernels gleaned after the harvest, is not manifest from stomach examination. Probably the birds take whichever is more accessible.

Rye was found in only one stomach and buckwheat in nine. The former was from a bird taken in May in Pennsylvania, and is evidently not a favorite food. Three birds taken in New Jersey in February were found to have eaten a small quantity of buckwheat. A single bird killed in July in New York and one killed in September in Iowa had also eaten this grain, as had four birds that were all taken at once in November in New Jersey. The buckwheat eaten in February and November must have been waste grain, and the fact that birds from the same localities, taken at the time when this grain was harvested, had not eaten it, indicates that it is not a desirable food and is eaten only under stress of hunger.

According to reports from the Southern States, crow blackbirds prey upon rice in company with other blackbirds and the bobolink, but unfortunately the collection contains few stomachs from this region, so that no corroborative evidence is at hand.

Although fruit of some kind is eaten in every month from March to December, inclusive, it does not become important until June. In June, July, and August it reaches 7, 13, and 10 percent, respectively. This aggregate is made up from a number of elements (see p. 64), but the only ones likely to possess any economic interest are blackberries, raspberries, cherries, currants, grapes, and apples. Apple pulp was found in 3 stomachs, grapes in 3, currants in 1, cherries in 37 in June and 14 in July, and strawberries in 7. The blackberries and raspberries were the favorites, and made up the great bulk of the fruit eaten. They were eaten from May to September, inclusive, but only a few in each month, except in July and August, when they were found in 96 and 68 stomachs, respectively. When we consider that the latter fruits are much more abundant in the wild than in the cultivated state, and bear in mind the small amount of other fruit eaten, it certainly must appear that the damage to fruit by crow blackbirds is of no great moment. None of the wild fruits mentioned in the table were found in large quantities or in many stomachs.

Mast, under which term are included chestnuts, chinquapins, acorns, and beechnuts, forms quite an important element in the fall and early spring months. It constitutes the principal part of the vegetable food of the 7 stomachs taken in January and does not appear in the 8 February stomachs to an important extent; but this record, based on only 15 stomachs, can not be considered very reliable. It composes about 10 percent of the March food, but decreases through the ensuing months till September, when it again becomes an important element and so continues through the rest of the year.

Weed seeds form another interesting element of vegetable food and are of considerable importance in the colder months. Beginning in February, they constitute more than 7 percent of the food, increase slightly in March, and then gradually diminish until they almost disappear in June, but again increase to a maximum of more than 11 percent in October. As all the plants included in this category are nuisances, it is, perhaps, needless to say that by eating their seeds the birds are doing good work.

The mineral component of the stomach contents possesses little, if any, economic interest, but it is curious to note how many different things a blackbird can pick up. Sand, gravel, pieces of brick, bits of mortar, plaster of paris, charcoal, hard coal, and cinders were the most common of the various hard substances which helped to line the mill in which their grist was ground. A glass bead was found in one stomach. Much of the gravel from stomachs of birds taken in

Kansas was found to contain fossil remains of corals, crinoid stems, shells, etc.

As previously stated, 456 nestlings are included in the 2,346 birds whose food has been already discussed. A separate study was made of these, in order to ascertain in what respect, if any, their food differed from that of the adults. It would have given more satisfactory results if it had been possible to separate the younger nestlings—say those under 1 week of age—from the older ones, for it was noticed that as the young approach maturity and get ready to fly, their food becomes more like that of their parents. The young were collected from May 22 to June 30, inclusive, and represent every age, from the newly hatched to those about to leave the nest. The whole food, when separated into its two principal components, was found to be as follows: Animal matter, 74.4 percent; vegetable, 25.6 percent. The much higher percentage of animal food in the young as compared with the adults (30.3 percent) is at once noticeable, although it may be insisted that the food of the young should be compared with that of the adults in the corresponding season; that is, in the months of May and June. If this view be taken, the difference is not so great. The percentage of mineral matter in the stomachs is also a little greater than in the case of adults.

The animal food is practically the same as that of the parent birds, and likewise consists chiefly of insects. These amount to 70 percent, 43 percent more than in the adults. The animal food other than insects, amounting to less than 5 percent, is not important enough to merit attention. The insect food is made up of about the same kinds as are eaten by the old birds, but in somewhat different proportions. Adult beetles, on account of their hard shells, are not fed to very young birds, but a few are given to the older ones. Grubworms (the larvæ of scarabæids) are fed freely after the first or second day. A little more than 19 percent of the food of the nestlings consists of this family of beetles, and for the most part in the form of the larvæ or grubs. Predaceous beetles (carabids) constitute about 10 percent of the food, weevils a little more than 3 percent, and there were traces of five or six other families, none of which reached 1 percent.

Grasshoppers and crickets, the former predominating, are a favorite food for the young, being softer and more easily digested than beetles. They constitute more than 21 percent of the total food. This is nearly as much as the parent birds consume in August, and three times as much as they eat in May and June, when they are feeding the young. This shows that they select the grasshoppers and other soft insects for their offspring, while they eat beetles and other hard things themselves.

Caterpillars constitute 6 percent of the food of the young birds, which is not as much as might be expected when we consider how soft and apparently well adapted they are for this purpose.

Besides the insects already mentioned, small quantities of ants, flies, bugs, May-flies, myriapods, and spiders were given to the young. These last merit a special notice from the fact that they form the earliest food of the bird. A number of tiny stomachs were examined, evidently taken from birds less than 24 hours old. In nearly every case they contained either a single spider or several very small ones—undoubtedly the bird's first meal. The very young stomachs are thin, almost membranous sacs, entirely unlike the stout, muscular gizzards of the adult birds, which explains why soft, easily crushed food is required for the newly hatched young. It is only after they have attained considerable growth and the stomach walls have become somewhat muscular that they are able to digest such food as hard beetles and corn.

The vegetable food of the young consists of corn and fruit, with mere traces of half a dozen other things. Corn amounts to 15 percent of the total food, but is fed only to the older birds, whose stomachs have acquired the requisite muscular strength to digest it. Fruit constitutes about 7 percent of the food, almost exactly the same quantity as is consumed by the adults in the month of June, and consists of the same varieties.

SUMMARY.

From the foregoing results it appears that the food of the crow blackbird for the whole year consists of animal and vegetable matter in quite unequal proportions. Of the animal component, nine-tenths are insects, and of the insects two-thirds are noxious species. The charge that the blackbird is a habitual robber of other birds' nests seems to be disproved by the stomach examinations.

Of the vegetable food it has been found that corn constitutes more than half and other grain less than one-seventh. Oats are seldom eaten except in April and August, and wheat is taken chiefly in July and August. Fruit is eaten in such moderate quantities that it has no economic importance, particularly in view of the fact that so little belongs to cultivated varieties.[1]

The farmer whose grain is damaged, if not wholly ruined, by these birds, may attempt to count his loss in dollars and cents, but the good services rendered by the same birds earlier in the season can not be estimated with sufficient precision for entry on the credit side of the ledger. And although the number of useful predaceous beetles they destroy is rather large, yet it must be considered that the final value of useful birds depends not so much on the character of the insects they destroy as on the extent of their work in keeping the great tide of

[1] In the appended table blackberries, raspberries, and other fruits of the genus *Rubus* are classed as cultivated fruit, since it is impossible to distinguish the wild from the cultivated in stomach examinations; but probably by far the greater part comes from wild plants.

insect life down to a proper level. The examination of the food of the blackbirds has shown that they do a good share of this work, and are therefore most emphatically useful birds—so useful that no general war of extermination should be waged against them. This does not mean that they do no harm, or that they should be permitted to do harm without restraint. A bird whose diet contains 46.5 percent of grain must be capable of considerable damage in any section of country where grain is an important crop; and when blackbirds descend upon a corn or wheat field in flocks of hundreds or thousands, they inflict a real loss, from which the farmer should protect himself by any practicable means. Still, crow blackbirds have not been complained of so much as redwings, and they probably do not ordinarily cause much loss to the farmer, since such a large part of the grain they eat consists of scattered or waste kernels. The local ravages they commit are usually due to overcrowding in a restricted area, and when this occurs there is no doubt that their numbers should be reduced.

The following table shows the percentage of each article of diet for each month:

Food of the crow blackbird.

[NUMBER OF STOMACHS EXAMINED: January, 7; February, 8; March, 53; April, 289; May, 348; June, 887; July, 346; August, 197; September, 81; October, 111; November, 11; December, 8. Total, 2,346.]

Food.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average.
ANIMAL.	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*	*Per-cent.*
Pred. beetles	7.1	0.3	4.3	6.3	8.5	12.9	11.1	9.1	3.1	2.6	1.5	0.5	5.6
May-beetle family	.....	0.1	3.2	6.8	22.0	15.1	8.0	0.8	0.6	0.5	.....	1.6	4.9
Snout-beetles	2.9	0.3	1.2	1.8	3.5	5.3	4.4	2.1	1.4	0.4	0.1	0.7	2.0
Other beetles	2.3	.....	1.2	1.3	1.7	1.9	1.3	0.9	0.5	0.1	.....	0.6	1.0
Caterpillars	4.3	0.3	1.2	2.3	8.2	3.6	1.2	0.7	1.3	1.3	.....	3.1	2.3
Grasshoppers	.....	0.6	0.8	1.2	8.8	14.6	12.7	23.4	8.1	6.9	9.0	1.9	7.3
Other insects	3.0	0.3	3.8	2.9	3.2	2.9	4.8	1.9	1.7	2.3	0.5	0.4	2.3
Spiders and myriapods	1.0	0.5	0.6	2.3	7.4	2.9	1.3	0.5	0.4	0.6	0.5	0.6	1.5
Crustaceans and mollusks	11.7	.....	0.1	1.6	1.9	2.4	0.9	0.2	2.6	2.3	9.9	3.1	3.1
Vertebrates	.....	.....	1.2	0.3	0.7	0.5	0.2	0.1	0.6	[1]Tr.	.....	.....	0.3
Total animal food	32.3	2.4	17.6	26.8	65.9	62.1	45.9	39.7	20.3	17.0	21.5	12.5	30.3
VEGETABLE.													
Corn	1.4	82.0	58.4	40.9	27.2	28.2	7.7	14.0	53.2	51.5	35.4	47.3	37.2
Oats	.....	1.2	0.9	14.5	2.2	0.4	5.2	9.3	1.1	0.8	.....	.....	2.9
Wheat	.....	.....	.....	1.2	0.6	0.2	26.1	25.9	0.8	.....	.....	.....	4.8
Other grain	.....	6.7	.....	0.6	0.3	.....	0.2	.....	[1]Tr.	0.8	10.5	.....	1.6
Domestic fruit	.....	.....	0.4	.....	[1]Tr.	5.8	10.3	9.1	1.3	0.4	.....	8.2	2.9
Wild fruit	.....	.....	1.7	1.2	0.4	1.3	2.7	1.3	1.5	2.2	4.5	8.1	2.1
Weed seed	.....	7.3	10.6	6.2	0.4	[1]Tr.	0.6	0.3	2.5	11.6	11.6	.....	4.2
Mast, etc	66.3	0.4	10.4	8.6	3.0	2.0	1.3	0.4	19.4	15.7	16.5	23.9	14.0
Total vegetable food	67.7	97.6	82.4	73.2	34.1	37.9	54.1	60.3	79.8	83.0	78.5	87.5	69.7

[1]Tr. = trace.

The following is a list of the various insects identified in the stomachs of crow blackbirds:

Insects found in stomachs of crow blackbirds.

COLEOPTERA.

Cicindela punctulata.
Cicindela purpurea.
Cychrus sp.
Carabus sp.
Calosoma scrutator.
Calosoma calidum.
Calosoma externum.
Pasimachus depressus.
Scarites subterraneus.
Amara sp.
Chlænius sp.
Agonoderus pallipes.
Harpalus caliginosus.
Harpalus pennsylvanicus.
Helophorus inquinatus.
Olophrum convexum.
Scymnus sp.
Hister americanus.
Ips quadriguttatus.
Drasterius elegans.
Drasterius dorsalis.
Podabrus rugulosus.
Canthon sp.
Phanæus carnifex.
Onthophagus hecate.
Onthophagus pennsylvanicus.
Atænius sp.
Aphodius fimetarius.
Aphodius inquinatus.
Bolbocerus farctus.
Geotrupes sp.
Dichelonycha elongata.
Macrodactylus subspinosus.
Lachnosterna sp.
Anomala varians.
Ligyrus gibbosus.
Allorhina nitida.
Euphoria fulgida.
Euphoria inda.
Cremastochilus sp.
Prionus sp.
Strangalia sp.
Cryptocephalus venustus.
Typophorus canellus.
Colaspis brunnea.
Chrysomela pulchra.
Gastroidea polygoni.
Haltica sp.
Dibolia sp.
Coptocycla signifera.
Eleodes tricostata.
Epicærus imbricatus.
Phytonomus punctatus.
Sitones hispidulus.
Lixus sp.
Balaninus sp.
Sphenophorus zeæ, et al.
Calandra granaria.

LEPIDOPTERA.

Leucania unipuncta.
Deilephila lineata.

HEMIPTERA.

Euschistus sp.
Prionidus cristatus.

NEUROPTERA.

Corydalis cornutus.

THE BOAT-TAILED GRACKLE.

(*Quiscalus major.*)

The boat-tailed grackle, one of the largest of the blackbirds in the United States, inhabits the South Atlantic and Gulf States from Virginia to Texas, and is not found at any great distance from the coast.

Its food habits have received but brief consideration from ornithological writers. Audubon, whose account is apparently the best, says:

> The food of this species consists principally of those small crabs called "fiddlers," of which millions are found along the margins of the rivers and mud-flats, as well as of large insects of all kinds, ground-worms, and seeds, especially grains. * * * In autumn, while the rice is yet in the stack, they commit considerable mischief by feeding on the grain, although not so much as when it is in a juicy state, when the planters are obliged to employ persons to chase them from the fields.[1]

In the preliminary investigations made by the Biological Survey there have been examined 116 stomachs from Florida, Georgia, and Texas, representing every month in the year (see p. 76). The food consists of 39.8 percent of animal matter and 60.2 percent of vegetable matter. The former is made up of insects and crustaceans, with a few lizards, batrachians, small mammals, etc. Crustaceans amount to about two-fifths of the animal food (15.6 percent of the total food), and consist of crayfishes, crabs, and shrimps, which plainly indicate the littoral habits of the species. No insects appear to be specially sought. Predaceous beetles (Carabidæ) are eaten to the extent of 3.3 percent and are taken mostly in fall. Other beetles are eaten to some extent, but no family is conspicuous. Grasshoppers are eaten in July and August, to the extent of 31.9 and 47.7 percent, respectively, but very few in any other month. The average for the year is 7.3 percent. Various other insects form 9.7 percent of the food, but no order is especially prominent. Six birds taken in Texas in September are worthy of special mention from the fact that they had all eaten cotton-ball worms (*Heliothis armiger*) in quantities varying from 26 to 93 percent of the food. While remains of small vertebrates are frequent in the stomachs, they do not form an important element.

Grain constitutes 46.8 percent of the total food. Of this all but a mere trace is corn, which composes part of the food of every month except May—the only stomachs collected in this month came from a rice field at Savannah, Ga., where corn was probably not readily obtainable. In each month except May and November corn constitutes more than half of the vegetable food, and in March, April, and August it is the only vegetable matter taken. April shows the greatest amount (92.7 percent of the total food), but as only 3 stomachs were taken in this month, this result can hardly be regarded as a fair average. The pulp of some large seed or nut, not otherwise identified, was the most important element next to corn. The remains of figs were found in several stomachs and wild grapes in one, which indicates that fruit is eaten, though sparingly. No weed seed was found in any of the stomachs.

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[1] Ornith. Biog., Vol. II, p. 504, 1835.

SUMMARY.

In summing up the results of the stomach examinations it is evident that no very salient points in favor of the boat-tailed grackle have come to light. In its insect food it has no very pronounced preferences, and while it does not cause any great havoc among useful insects, it does not prey extensively upon harmful ones. In common with most other land birds, it eats grasshoppers freely in July and August, and it would probably eat caterpillars as well if it found them more plentiful than other food. The animal food it decidedly prefers is small crustaceans, and these, so far as the interests of agriculture are concerned, are entirely neutral.

In its vegetable diet, the bird certainly does not commend itself to the agriculturist. Its preference for corn is very marked and shows no variance with the change of season. That it visits the growing crop for its supplies is evident from the fact that much of the corn found in the stomachs during the early summer was 'in the milk.' In any locality, therefore, where this grackle is very abundant it must almost necessarily be harmful to the corn crop without rendering any well-defined service in return.

DISTRIBUTION OF STOMACHS.

Distribution of stomachs, by months and States.

BOBOLINK.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Connecticut					12	1	8	4					25
Dist. of Columbia								4	17				21
Georgia					2				7				9
Iowa					2								2
Kansas					4								4
Massachusetts					3	2	4						9
Michigan					2								2
Minnesota					2	4	1	3					10
Montana								9					9
New Jersey								10					10
New York					11	10	6	34	1				62
North Dakota						1	7	13					21
Pennsylvania					4	20	9	10	5				48
Rhode Island							3						3
South Carolina									2				2
South Dakota							2						2
Texas					3								3
Virginia					3			1	15				19
West Virginia									1				1
Wisconsin					3	3	2	7	2				17
Ontario, Canada					1		3	8					12
Total					52	41	45	103	50				291

Distribution of stomachs, by months and States—Continued.

COWBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Arizona					1	1							2
Connecticut				7	3				1				11
Dist. of Columbia											3		3
Georgia			4										4
Illinois			2	1	2								5
Iowa				6	4	1	3			1			15
Kansas			2	36	54	24	10	5	2				133
Kentucky										2			2
Maine								1					1
Maryland							1						1
Massachusetts				5	6		2						13
Michigan							1						1
Minnesota					5	3		1					9
New Jersey			1	5		1		6	7		2		22
New York				7	10	3	7	6	63	8			104
North Dakota							4	9					13
Ohio				4			2						6
Pennsylvania			6	6	9	15	22	6	1	5	1		71
Rhode Island							1		1				2
South Dakota					1		2						3
Tennessee											1		1
Texas	3	10	2	3		2	1	3	4	54	16	2	100
Virginia												9	9
West Virginia								1					1
Wisconsin			1	3	1	3	1						3
Canada					3								3
Total	3	10	18	83	99	53	57	38	79	70	23	11	544

YELLOW-HEADED BLACKBIRD.

California					1								1
Iowa					1								1
Kansas				5	13								18
Michigan										3			3
Minnesota					11	10	9	28					58
Nebraska				1	1								2
North Dakota						4	3	24	4				35
South Dakota					1								1
Texas				3									3
Wisconsin							4	7					11
Wyoming								1	1				2
Northwest Territory, Canada					3								3
Total				9	31	14	16	60	5	3			138

Distribution of stomachs, by months and States—Continued.

RED-WINGED BLACKBIRD.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Arizona					8								8
California		1		2									3
Connecticut			3	5	6		6						20
Dist. of Columbia		2		1			2	4		4	4		17
Florida				2									2
Georgia					2								2
Illinois			5	3	2								10
Indiana							3						3
Iowa			5	5	2			1		40			53
Kansas			10	15	4	19	22						70
Maryland			1	2	3	54	11	22	2				95
Massachusetts	1			7	5	14	2						29
Michigan					1								1
Minnesota				2	12	5	13	21	2	2			57
Missouri			1										1
Nebraska				1	1			1					3
New Jersey			8	6	1						2		17
New York			2	9	14	12	8	7	2	4	1		59
North Dakota						2	6	42	1				51
Ohio				1									1
Pennsylvania			10	28	5	41	51	45	4	2			186
Rhode Island							1						1
South Carolina			1										1
South Dakota			3		2			2					7
Texas	10	45	34	11		8	11	1	31	29	70	81	331
Utah										2			2
Vermont										1			1
Virginia						1	5		8	5	5	1	25
West Virginia								2	4	1			7
Wisconsin			1	1	4	2			2				10
Wyoming								2					2
Ontario, Canada				3	3			1		1			8
Total	11	48	84	104	75	158	141	151	56	91	82	82	1,083

CALIFORNIA RED-WINGED BLACKBIRD.

California	2		3	2		13	1		2	18	13	7	61

RUSTY BLACKBIRD.

Connecticut			3	4						4			11
Dist. Columbia				1							4	1	6
Georgia			3										3
Illinois			1	6									7
Iowa				2	2					1			5
Kansas	1		5	20						5	5		36
Massachusetts			2	2	1					3			8
Minnesota				3					1	1			5
New Jersey											2		2
New York			1	4	4				2	8		1	20

Distribution of stomachs, by months and States—Continued.

RUSTY BLACKBIRD—Continued.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
North Dakota	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1
Ohio	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Pennsylvania	.....	.....	.....	5	.....	.....	.....	.....	.....	.....	1	.....	6
Texas	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	2	1	9
Virginia	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	1	.....	2
West Virginia	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1
Wisconsin	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	2
Nova Scotia	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	4
Ontario, Canada	.....	.....	1	.....	.....	.....	.....	.....	1	1	.....	.....	3
Total	1	6	17	49	7	.....	.....	4	5	25	15	3	132

BREWER'S BLACKBIRD.

California	7	1	4	.....	1	10	9	.....	7	14	10	6	69
Montana	.....	.....	.....	.....	.....	.....	.....	12	13	.....	.....	.....	25
North Dakota	.....	.....	.....	.....	.....	.....	1	8	18	.....	.....	.....	27
South Dakota	.....	.....	.....	.....	6	.....	.....	.....	.....	.....	.....	.....	6
Texas	.....	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	9	15
Wyoming	.....	.....	.....	.....	.....	.....	.....	4	.....	.....	.....	.....	4
Total	7	7	4	.....	7	10	10	24	38	14	10	15	146

CROW BLACKBIRD.

Alabama	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1
Connecticut	.....	.....	9	23	12	8	6	.....	.....	1	.....	.....	59
Dist. of Columbia	.....	.....	1	1	7	15	48	9	.....	9	1	.....	91
Florida	.....	.....	2	3	.....	.....	.....	3	.....	1	.....	1	10
Illinois	.....	.....	2	7	8	.....	9	3	.....	4	.....	.....	33
Indiana	.....	.....	.....	2	1	.....	1	.....	.....	.....	.....	.....	4
Iowa	.....	.....	.....	10	4	.....	1	2	12	10	.....	.....	39
Kansas	.....	.....	1	67	217	570	29	.....	6	6	.....	.....	896
Kentucky	.....	.....	.....	.....	1	.....	.....	.....	.....	4	.....	.....	5
Louisiana	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	3
Maine	.....	.....	.....	1	.....	.....	.....	.....	.....	1	.....	.....	2
Maryland	.....	.....	1	28	3	210	159	152	3	.....	2	.....	558
Massachusetts	.....	.....	.....	10	.....	.....	.....	.....	.....	.....	.....	.....	10
Michigan	.....	.....	.....	6	2	.....	.....	.....	.....	.....	.....	.....	8
Minnesota	.....	.....	.....	2	3	6	2	.....	.....	.....	.....	.....	13
Missouri	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Nebraska	.....	.....	.....	3	.....	.....	.....	.....	2	20	.....	.....	25
New Jersey	.....	3	1	11	1	.....	1	.....	5	.....	5	.....	27
New York	.....	.....	7	17	17	11	1	1	29	9	.....	.....	92
North Dakota	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	.....	.....	6
Ohio	.....	.....	.....	2	.....	2	4	3	18	.....	.....	.....	29
Pennsylvania	.....	.....	20	94	62	63	72	12	6	45	1	.....	375
South Dakota	.....	.....	.....	1	.....	.....	.....	.....	.....	1	.....	.....	2
Tennessee	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	1	3
Texas	7	5	4	.....	2	2	.....	.....	.....	.....	.....	6	26
Virginia	.....	.....	2	.....	.....	.....	11	3	.....	.....	.....	.....	16

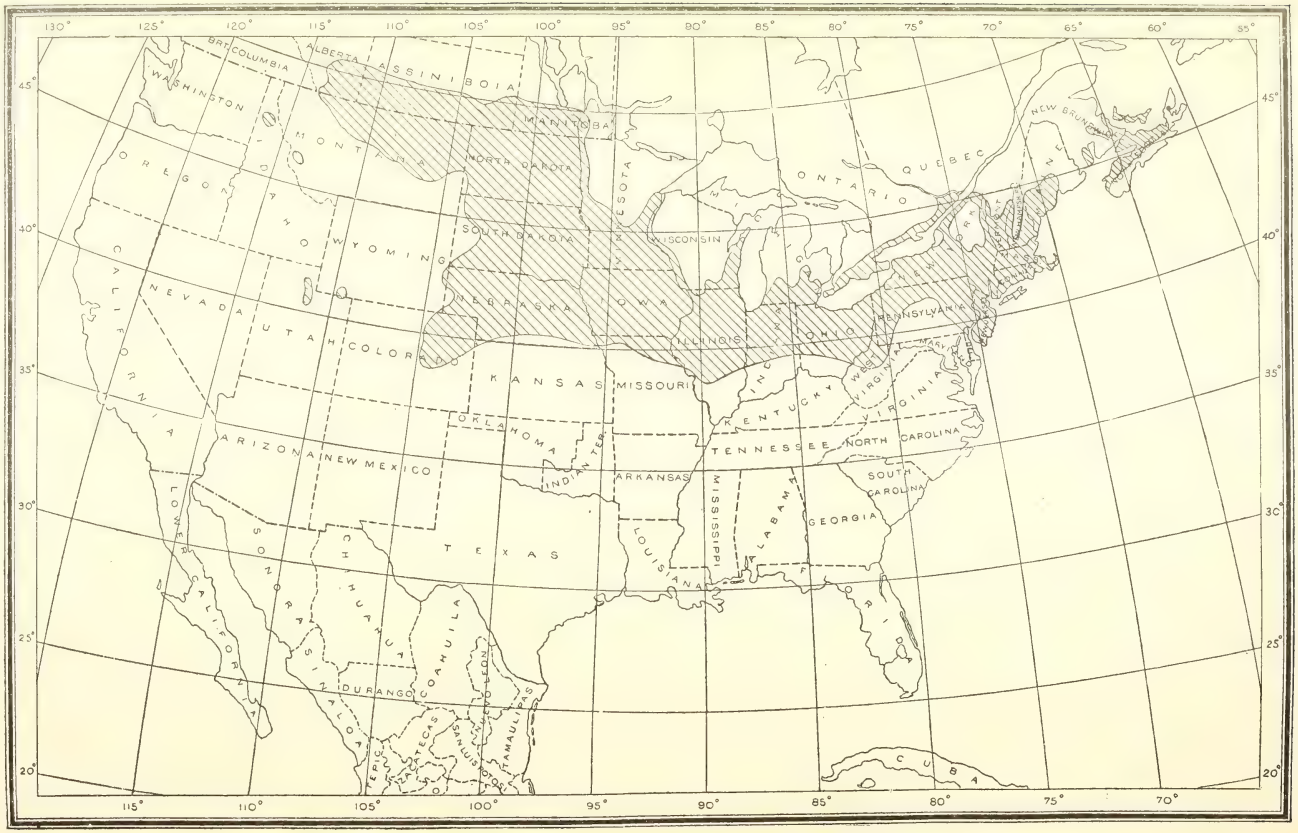
Distribution of stomachs, by months and States—Continued.

CROW BLACKBIRD—Continued.

States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
West Virginia	.....	.....	.....	.....	.....	.....	.....	3	.....	.....	.....	.....	3
Wisconsin	.....	.....	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	3
Ontario, Canada	.....	.....	3	.....	.....	.....	2	.....	.....	.....	1	.....	6
Total	7	8	53	289	348	887	346	197	81	111	11	8	2,346

BOAT-TAILED GRACKLE.

Florida	1	.....	.....	.....	.....	.....	.....	2	1	1	.....	.....	5
Georgia	.....	.....	.....	.....	8	.....	.....	.....	.....	.....	.....	.....	8
Texas	23	20	3	3	.....	12	14	2	8	4	5	9	103
Total	24	20	3	3	8	12	14	4	9	5	5	9	116



MAP SHOWING BREEDING RANGE OF THE BOBOLINK (*Dolichonyx oryzivorus*).

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